THE
ELECTRICAL REVIEW.

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THE
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MONEY MATTERS.

THE key-note of the presidential address delivered by Mr. Chamen last week at the Glasgow Convention of the Municipal Electrical Association is given in his own words:—"The whole business," *i.e.*, the getting out of more units from the plant in a station by finding some demand that shall make longer use for it, "settles down comfortably on his," the engineer's, "shoulders, and he has in the end to suggest some remedy." This dry and uninteresting subject, as Mr. Chamen calls it, is the one that experience shows needs more attention than almost any other. Engineers have a choice of mains, of machinery and plant, any reasonable combination of which will allow success to result from the establishment of a supply system, provided that regard is given to the financial soundness of the policy controlling capital expenditure and methods of charging for supply. Attention has to be drawn to this "all-important question of money." Glasgow has learnt the same lesson as Manchester, only in a milder degree. Provincial town after town is feeling the pinch, and the reports of the Metropolitan boroughs tell the same tale.

The first and a most vital point is the provision of interest and sinking fund. Under the system of payment by monthly or periodical certificates the contractor draws nearly the whole value of the plant long before beneficial use can be made of it, and if adjustments and alterations have to be made, the owner has to hold back customers until everything is ready, although the 80 or 90 per cent. of the value has been handed over to the maker of the machinery, and interest accrues thereon, as well as a call for sinking fund. It has been suggested that as plant or mains usually require about two years to become remunerative, the first payment of interest or sinking fund contribution should be withheld for such a period of grace, when it would be provided by moneys earned by the plant upon whose capital it was calculated. This would do away with the unfairness of being overtaxed during the first few years, when the extensions not only do nothing to improve the commercial position of an undertaking if in municipal hands, but actually put a severe drag upon the older portion, which a year or two ago may have been paying its way and enabling a reserve fund to be built up by the profit balances earned. It is not clear from any point of view that a relaxation of this rule would be bad or unsound finance. If the Local Government Board can be brought to understand how obvious it is that a concern should not be asked to make heavy annual payments until it has time and opportunity to bring in a revenue in some degree proportional to the capital which has been expended upon it, the day of better things may come and the prospects of undertakings all over the country will be greatly improved. But

we cannot agree to one suggestion—that the interest should be transferred to capital account during this period of easement. We believe Parliament and the departments that control finance are strongly opposed to any attempt to capitalise interest charges, and this we consider to be a sound view to hold. All that seems to be really necessary or desirable is to shift the term of repayment of local authorities' loans forward in time by two or three years, so that instead of having to meet these outgoings at once upon taking up a loan, a short time of non-payment is permitted, after which the period of repayment commences, and continues to run for the term usual in such cases, being extended in this way as far behind as it was late in beginning. This, however, is not the main topic of Mr. Chamen's address, although distinctly and acutely a money matter to station engineers under a local authority.

The rest of the address, and the major portion, is an exceedingly well-put argument in favour of a sliding-scale charge for energy. Notwithstanding all that has been written by the late Dr. John Hopkinson, Mr. Arthur Wright, Mr. W. L. Madgen, Mr. Hordern, and engineers of different ranks in the profession, there is still much to be said on the subject, and Mr. Chamen has succeeded in finding not only something new to say, but also has put some old arguments in a new form. The average councillor and the everyday shopkeeper are as yet unconvinced of the necessity for a sliding scale. They fail to realise its operation, and grumble at the effect it has upon the more heavily-rated and influential early-closing shopkeeper, who is often quite able to make his voice heard through mouthpieces in the Council Chamber. That this is so has been pointed out in these columns before, and we have seen town after town passing resolutions to reduce the first hour or initial rate of charge—a course which can only have been admitted by the engineer because he knew it was inevitable, and felt it fruitless and useless to oppose. To all such persons we commend Mr. Chamen's story of the old woman who made a loss on every article she sold. Old women are not generally regarded as exceptionally useful members of society, but such an old woman would be sure to understand and support the contentions of a municipal engineer who could present such a good case as does the President of the I.M.E.A. After all, facts are powerful weapons, and the application of analysis to the Glasgow accounts brings out the case for a sliding scale better than any mere theorising. As Mr. Chamen put it, the plant could have sold over 80 millions of units; it did sell between 6 and 7 millions. The actual sales had to bear the whole of the burden of financial and stand-by charges, and therefore any increase in the sale could have been met by an actual charge of much less than 1d. per unit. With capital representing about £114 per KW. installed, the fixed charges required over £8 per KW. per annum, a figure obtained by dividing the gross standing charges by the sum of the demands of all the consumers connected, and allowing for a "diversity factor" of 25 per cent. The notion of this diversity factor is not, of course, new as Mr. Wright has applied it in dealing with the Brighton accounts. Table A in the address is most instructive; the only omission is a class, that of places of worship, which would come at the bottom of the list. We should like Mr. Chamen and others who recommend, or agree to, specially low rates for churches and chapels, to tell us why they do so, and to show the reconciliation between such preferential treatment and the main argument of this address. No doubt we should learn that it is based upon public interest; that just as places of worship are relieved from rates, and those of the Established Church are not burdened with the cost of making up new streets, so non-profit earning consumers are not called upon to be profit-yielding. The exact position that hospitals and dispensaries occupy with regard to churches has still to be defined, and what applies in the cases of places of worship may later be extended to all charities or concerns which clearly are not run on commercial lines for pecuniary gain. The Metropolitan Borough Councils are disposed to look at things the other way, and say that those who enjoy or desire such privileges as come from assisting or maintaining special premises in which to meet should pay for them, and that preferential treatment is undesirable. The paying consumer on a station load is the one who gets his energy cheap; a flat rate cannot give such a cheap supply—and would an undertaking be able to keep a consumer who pays, say, 2d. if the uniform rate of "3½d. or perhaps 4d." be introduced, or the output "be increased at the rate of 50 cent. per annum as Glasgow has done for the last two years, if a uniform rate be reverted to"? Even Brighton, the home of the demand indicator, goes further than the simple demand scale, and cuts out the indicator by automatic or hand switches during the summer, thus giving for a period of the year a flat rate of 1d.!

The address deals lastly with power supply, and, doing what is not often achieved, shows clearly why lower rates should be charged for power than for lighting. Mr. Chamen's old firm sometimes utilises other pages to call attention to the value of motors, and would have one believe they filled up the valleys in the load curve. The author is not so sanguine; he says they do not simply fill up the load diagram in the shallow places, but the proportions of the peak to the whole diagram is reduced by getting on a greater number of consumers who use current longer, and power supply is the way of producing this result. The power companies evidently desire this flat load. Variable loads like lighting may be left to the municipalities. Then the ratio of "plant rental" to the current rental is reduced, and the former being a fixed charge, the average will be low; lower, indeed, than the local authorities can possibly touch. The address itself appears elsewhere in this issue, and need not be missed by technical readers; that it will ever reach the other persons most interested, the consumers, is out of the question, but it has been good in two ways. Firstly, it was delivered before a commercial rather than a scientific body. Members and chairmen of committees were present, and more of the same class will read it. They will consider and weigh its contents and apply its reasoning to local conditions. Secondly, it gives some new phrases and thoughts with which to enlighten consumers and rebut critics, a new armoury of facts and fancies upon which to draw when hard pressed by the keen interests calling for a flat rate. And the value of the address is enhanced by the source from which it comes, for we have heard that not so long ago Glasgow was by no means favourable to the sliding scale, that its disuse or limitation was under consideration, and that its disadvantages were held to outweigh its advantages in the Scottish commercial capital.

THE SALARY OF A BOROUGH ELECTRICAL ENGINEER.

A legal query which we publish elsewhere in this issue, and to which our legal correspondent has furnished an answer, raises an interesting question as to the assessment of the salary of an electrical engineer to a corporation. According to the news-cuttings to which our attention has been drawn, it appears that the city electrical engineer of a town in the North of England made application for a rise in salary. The following resolution was proposed and seconded at the meeting to which the question was referred :—

"That after considering the result of the last financial year in the electricity department, the salary of the city electrical engineer be raised to £300 per annum, *and that in consideration of the supervision of the extensions of the plant a bonus of one per cent. be paid to him on all completed work on capital account.*"

As might have been expected, the local press are much concerned about this "new departure," which they describe as a "bad precedent." It appears that the Town Clerk was of opinion that while it would not be illegal for the Corporation to pay, it would be illegal for an engineer to receive such a commission ; and it is stated that one of the aldermen who was bitterly opposed to the "new departure" had expressed his intention of prosecuting the unfortunate engineer if he presumed to accept the commission when thrust upon him.

In answering the queries put to us, we have expressed the view that, assuming the city electrical engineer was appointed under the Public Health Act, the proposed resolution of the committee is *ultra vires*, and the acceptance of any such commission by the engineer would expose him to an action for penalties. It has been decided, moreover, that such penalties cannot be remitted ; but with a view to protecting public officials against unwarrantable claims, it was provided by an Act passed in 1884 that no such action shall be commenced except with the consent in writing of the Attorney-General.

The Acts and cases which point inevitably to the above conclusion are as follows :—

By Sec. 189 of the Public Health Act, 1875, it is provided that "Every urban authority shall from time to time appoint fit and proper persons to be medical officer of health, &c. . . . . Every urban authority shall also appoint or employ such assistants, collectors, and other officers and servants as may be necessary and proper for the efficient execution of this Act. . . . . The urban authority may pay to the officers and servants so appointed or employed such reasonable salaries, wages, or allowances as the urban authority may think proper, and subject as aforesaid ; every such officer and servant appointed under this Act shall be removable by the urban authority at their pleasure. It is also provided by Sec. 193 of the Public Health Act that officers or servants appointed or employed under that Act by the local authority shall not in anywise be concerned or interested in any bargain or contract made with such authority for any of the purposes of the Act ;" and the section goes on to provide that if any such officer or servant is so concerned or interested, or, under colour of his office or employment enacts or accepts any fee or reward whatsoever, *other than his proper salary, wages and allowances*, he shall be incapable of afterwards holding or continuing in any office or employment under this Act, and shall forfeit any pay, the sum of £50, which may be recovered by any person, with full costs of suit by action of debt. The important words are in italics. It would seem at first sight that if the borough sanitary inspector (for instance) accepted a commission authorised to form part of his salary, he could not be impugned under this section. The above provision is intended to apply to fees from persons other than the local authority, and is levelled at the practice of demanding fees from persons seeking aid from the board, or exposed to proceedings by them. The language used, however, is sufficiently general to prevent the officer receiving gratuities for extra services rendered to the board. Instance the following case.

By the terms of contracts entered into with a local authority for the purpose of the Public Health Act, the surveyor to the local authority was to receive from the contractors, in respect of bills of quantities to be prepared by them, percentages on the amounts he should certify to be due to such contractors respectively by the local authority. It was decided that in respect of each contract the surveyor was liable to a penalty as having been concerned or interested therein within the meaning of the section. In another case, the local authority employed their surveyor, apart from his ordinary duties, to superintend the construction of certain drainage works as their engineer, and agreed to remunerate him to a percentage on the outlay. It was held that he was liable to the penalty imposed by this section [Whiteley *v.* Barley 21 Q.B.D., 154].

Again, in the case of Reg *v.* The Mayor of Ramsgate, [23 Q.B.D., 66], a local authority employed one of their officers, apart from his ordinary duties, to superintend the execution of certain works on their behalf upon the terms that he should be paid for his services by a commission upon the contract price of such work, whereby he became interested in the contract for the works, contrary to the provisions of Sec. 193 of the Public Health Act, 175. The officer duly superintended the execution of the works, and the local authority passed resolutions for the payment of, and paid him the amount of, the stipulated commission. On application for a *certiorari* to bring up such resolutions for the purpose of quashing them, it was admitted by the defendants that the payment was invalid, but it was contended that a fixed sum equal to the amount of the commission might have been lawfully paid to the officer as an "allowance" under Sec. 189 of the Public Health Act, 1875, and that the invalidity of the payment being in form rather than in substance, the Court in the exercise of their discretion ought to refuse the application. It was decided that the payment being illegal, the application must be granted—and impliedly that the word allowance in Sec. 189 does not include an allowance of money. [Reg *v.* Ramsgate, 23 Q.B.D., 66].

It is important for members of local authorities to note that in case illegal allowances are made to surveyors or other officers, and the order making such allowances is afterwards quashed, they must pay out of their own pockets the costs which the applicant incurred in obtaining the *certiorari*. In the Queen *v.* Vaile and others, Whiteley the applicant for the *certiorari*, in the case of Reg *v.* Mayor of Ramsgate (*ubi. sup.*) had obtained a rule to show cause why Vaile and others, members of the Town Council of Ramsgate, should not be ordered to pay the costs of the applicant of and incidental to the applying for the *certiorari*. It was decided that those really responsible were those who had joined in making the order, and they were held liable.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

In point of numbers the Glasgow Convention has overshadowed all previous gatherings, but the papers, with, perhaps, two exceptions, were not so good as those to which we have been accustomed, nor were the so-called discussions so fruitful in imparting useful information.

We use the expression "so-called discussions" advisedly, for the majority of the speakers, whether engineers, aldermen, or town councillors, apparently possess but vague notions of the laws of debate.

The statement and consideration of arguments for and against the matter under discussion gave place to mere platitudes—flat, dull, commonplace remarks on what this or that town had done, was doing, or intended to do.

In some instances speakers wandered hopelessly away from the subjects at issue, which caused a waste of precious time, and necessitated other and more able debaters being limited, in some cases, to two minutes—a period of time quite inadequate to serve any useful purpose at meetings like these.

Those who religiously sat out the three days can appreciate the feelings of Cowper when he penned the lines :—

> Preserve me from the thing I dread and hate,
> A duel in the form of a *debate*.

Naturally, to such excellent speakers as Mr. Wordingham, Councillor Worthington, Mr. Rider, Alderman Pearson, Dr. Panton, and a few others, one can always listen with both pleasure and profit, for their utterances are usually based upon certain special points which they have noted in the papers, and are, therefore, full of sound sense. But the inexperienced debater gets on his hind legs and attempts to deal with the paper as a whole without having read, learned, and inwardly digested any part of it, with the result that he loses track of all he would have liked to say, and ultimately sits down without having added one iota of real information to the gathering, and in every instance curtailing the time which might otherwise be allowed for those who do know what they are talking about.

Possibly, however, the necessity which arose both on Wednesday and Thursday for reversing the order of the papers, may have in some degree accounted for the character of the discussions; moreover, the fact that the points made by Mr. Rider had just before been anticipated by the action of the Board of Trade, rendered any discussion on his paper nugatory, but certain it is that on Friday they were brighter and more to the point, but then the papers may have lent themselves to this decided improvement in debate.

The President, of course, invariably calls upon any well-known man who is an expert on the matter under discussion, but it would certainly appear advisable at future meetings to ask those who volunteer to add to the debate, to confine themselves to some particular point on which they have definite knowledge, and if they go away from it to be gently but firmly brought back again.

For example, what earthly reason was there for several precious minutes to be taken up on the opening day, for a learned disquisition of the effect of light upon our organs of vision? To such an audience, unless, indeed, the speaker imagined he was addressing a class of small boys about to enter for the elementary certificate of the South Kensington Science and Art Classes, it was like teaching one's grandmother to suck eggs, out of place, and "all my eye."

When during an occasional bright interval we seemed likely to get a connected series of statements or reasons intended to establish a position, the discussion too frequently resolved itself into the *argumentum ad populum*—argument based upon public opinion often appealing to the prejudice of the hour rather than to intelligence.

> The pupil of impulse, it forced him along,
> His conduct still right, with his *argument* wrong.

As an instance of pithy, terse and brief argument, we may cite Mr. Rider's contribution to the wayward discussion which followed Mr. Highfield's paper, the gist of which may be embodied in the question—Is it, or is it not, desirable that refuse destructors should be combined with electric power stations? Mr. Rider advised that destructors should be considered from the sanitary point of view only—that they should be under the control of the borough engineer or surveyor, and that the municipal electrical engineer should let them severely alone. He spoke from personal experience, and his remarks were decidedly appreciated; the majority of the other speakers, however, excepting perhaps Mr. Edgcome, went quite out of their way upon side issues.

Mr. Chamen evidently did everything he could in his genial and kindly way to keep his flock from straying, but as he himself candidly confessed, other pressing matters had rather interfered with his complete grasp of the contents of the papers submitted, and we therefore lost that brief but masterly summing up at the close of each subject to which we had looked forward.

In our last issue we briefly referred to the first day's proceedings, which were followed by the annual dinner, held at the Windsor Hotel, the President taking the chair.

After the usual loyal and patriotic toasts Mr. Alderman Pearson proposed, in, for him, a somewhat laboured and lugubrious manner, "The Lord Provosts and Corporation of the Cities and Counties of Glasgow and Edinburgh," to which Lord Provost Chisholm, one of the most charming of post-prandial orators, replied. "There had long existed," he said, "a most friendly rivalry between Edinburgh and Glasgow, the one being acknowledged to be the capital, and the other professing to have the capital, and so between them they together laboured for the advancement of their common country." He also referred to Glasgow's municipal enterprises. Mr. Newington, Edinburgh, whose work we think scarcely received due acknowledgment, briefly responded on behalf of Edinburgh. Lord Provost Chisholm submitted the toast of "The Incorporated Municipal Electrical Association," and referring to the keen competition at present existing between gas and electricity, stated that if they looked round them and saw the recent improvements in gas they would recognise that all their strength and energies must be reserved to compete successfully against it. The Chairman, in reply, appreciated the remarks of Lord Provost Chisholm, and stated that he had not the slightest doubt but that the improvements which had been obtained by incandescent gas lamps would in due time be gained also by electricity.

Toasts of the "Scientific Institutions," "The Visitors," and "Our Entertainers" were also given by Mr. T. P. Wilmshurst, Mr. J. H. Rider, and Bailie W. Maclay, and responded to respectively by Dr. Magnus M'Lean and Mr. W. Foulis, Bailie J. Gray and Mr. Mark Robinson, and Mr. J. B. Rosenthal.

On Thursday the Convention was held in Edinburgh, and the two papers, "Braking Apparatus for Electric Cars," by Mr. Fell, and "The Equitable Allocation of Costs in Combined Lighting and Traction Stations," by Mr. Tittensor, were discussed.

Ex-Bailie Mackenzie, convener of the Edinburgh Corporation Electric Lighting Committee, at the outset of the proceedings, in the absence of the Lord Provost, welcomed the members to Edinburgh. On the previous day, he said, they were in the large and important city of Glasgow. As the Lord Provost of Glasgow had said, there was a little rivalry between their two cities. They, on the Edinburgh side, looked with great admiration towards Glasgow. They knew that Glasgow was most enterprising, and was the second city of the Empire in regard to population, and probably also in regard to enterprise and prosperity. In Edinburgh they could not hope to show to the Association anything in the electrical line to compare with the electrical glories which on the previous day they saw in Glasgow. They there saw ponderous engines and many other things of American origin. There were many people who considered that it was a great mistake that Scotland did not allow herself to be conquered by England 600 years ago, and it might be true that they in Edinburgh should have allowed themselves to be captured by the Americans, in the same manner in which the Americans, he believed, had captured the great city of Glasgow. Knowing the enterprise and the wealth of Glasgow, he could not help thinking on the previous day that it would have been a good thing if the Glasgow Corporation had gone a little further, and rather than have followed in the footsteps of the great American cities in the introduction of electric overhead traction, have gone in for something in the way of underground electric traction. Looking at what he saw in Glasgow, he could not help coming to the conclusion that an overhead system, no matter what its merits from the pure standpoint of facilitating travel from one part of a city to the other, was only a temporary expedient. In Edinburgh they had a little to show the members of the Association in the way of electric lighting, although not much in the way of electric traction. They only began six years ago; they had already two power stations, and they were progressing in the most satisfactory manner. They started in a comparatively small way, but at the present time they had connected to the mains close upon the equivalent of 370,000 8-C.P. lamps; and of that large quantity the equivalent of 2,100 H.P. was employed in motors, which latter quantity was always increasing. At the present time he believed Mr. Newington had applications equal to 15,000 or 20,000 8-C.P. lamps. In the meantime it seemed to him that the weak point in electric lighting was the want of storage and the necessity for keeping a large amount of plant, the most of which—probably three-fourths or five-sixths—was idle for about seven months of the year, and even during the remaining months of the year was idle for most of the 24 hours. Theirs was not an industrial city, but they had a great many small users of power, to whom

they now gave the current at 1½d. per unit. Since they came down to that figure the increase in the demand for motor power had been very satisfactory indeed. During the last year they had had the equivalent of 700 H.P. joined on.

The President, in acknowledging the welcome which ex-Bailie Mackenzie had extended to the Association in the name of the Corporation, said that Edinburgh was a place to be visited in order to see how an electric undertaking should be conducted. The Edinburgh people did not start their undertaking until some little time after Glasgow. Glasgow, too, had awkward things to deal with. It had to buy up other companies; whereas there was no such position in Edinburgh; and the Corporation of Edinburgh started from the first with the very best advice they could get—that of Prof. Kennedy. There was nothing, so far as he could learn, which the Edinburgh Corporation had put down in the way of electric lighting plant or generating stations which there was any cause for them to regret. They were, of course, in the same awkward position of all of them before the Board of Trade regulations were altered, and when they started he knew that in order to reach some of their districts they had to resort to high-tension alternating plant. Since that time, however, he believed he was right in saying that, with the exception of some distant districts, such as Portobello, the alternating plant was being entirely thrown out of use, and that the increased pressure of 460 volts had enabled them to do practically the whole of the city of Edinburgh proper with continuous current generated direct.

Members were later entertained at luncheon by the Edinburgh Corporation, the Right Hon. James Steel, Lord Provost, in the chair. The remainder of the day was spent in visiting the Corporation electricity works, the power stations of the cable tramways, the works of Messrs. D. Bruce Peebles & Co., and of Messrs. Mackenzie Bros., and the Forth Bridge.

Messrs. D. Bruce Peebles & Co. had provided a delightful surprise for their visitors in the shape of a garden party, with light refreshments for the inner man, and music, which sank deep into their souls, from a band of pipers of the 5th Battalion Royal Scots. The military band of the regiment was also in evidence, but that didn't count. Of each of these seven stalwart Highlanders Chaucer would have said:—

A bagpipe wel coude he blowe an soun,

and the skirl of their shrill and peculiar tones held the party awestruck while an acrobatic drummer filled us all with wonderment at the deft way in which he handled the sticks.

Friday saw us again in the Second City of the Empire, and with the reading and discussion of Mr. Highfield's paper on "Refuse Destructors in Combination with Electric Power Stations," and Mr. Chattock's text-book essay on "Coal and Ash Conveying Gear," the Conference came to an end, except for the annual general business meeting in the evening. During the afternoon the following works were open for inspection:—Glasgow Corporation Tramway Car Works; Messrs. G. and J. Weir, Limited, pump works; the works of Messrs. Mavor & Coulson; and the sewing machine factory of the Singer Manufacturing Company.

The business meeting was conducted in private so far as press representatives were concerned, but from a report which has been supplied to us by the secretary, we learn that the proposal to hold the 1902 meeting in London, with Mr. J. H. Rider as President, was passed. The Executive Council now stands as follows:—

President.

J. H. Rider, L.C.C. tramways.

Vice-Presidents.

J. F. C. Snell, Sunderland. T. P. Wilmshurst, Derby.

Past-Presidents.

H. Faraday Procter, Bristol. W. A. Chamen, Glasgow.
A. B. Mountain, Huddersfield.

Council.

L. Andrews, Hastings.
A. S. Barnard, Hull.
J. E. Edgcome, Kingston-on-Thames.
A. Ellis, Cardiff.
J. S. Highfield, St. Helens.
Bailie A. D. Mackenzie, Edinburgh.
F. A. Newington, Edinburgh.
Dr. Panton, Bolton.
R. C. Quin, Blackpool.
Councillor J. P. Smith, Barrow-in-Furness.
C. D. Taite, Pendleton.
Councillor Worthington, Wigan.

Hon. Solicitor.

Ald. G. Pearson, Bristol.

Hon. Treasurer.

J. H. Rider, chief engineer L.C.C. tramways.

Hon. Secretary.

E. T. Ruthven Murray, Public Offices, Dyne Road, Kilburn, N.W.

Secretary.

C. McArthur Butler, St. James's Hall, Piccadilly, W.

The sixth annual report, which was adopted, referred among other matters to the part played by the Association in connection with the recent Board of Trade Conference in London *re* higher voltage supply. "Wiring rules" had been receiving the consideration of the Council during the year, but in consequence of the Institution of Electrical Engineers having appointed a committee to amend its existing rules, and the Association being represented on the committee by Mr. C. H. Wordingham, a Past-President, it was deemed undesirable to take further action in the matter of issuing rules. Subsequently, the Institution of Electrical Engineers invited the Association to appoint a representative to sit on the committee, and the Council accordingly appointed Mr. H. Faraday Procter to represent the Association.

The report showed that the question of endeavouring to obtain an alteration in the method of repayment of loans, so as to relieve local authorities from being compelled to pay the annual instalment on a given loan for the first three years, had received some attention. A sub-committee is still dealing with the matter.

The question of formulating rules for the use of police in cases of emergency arising out of breakage of trolley wires was to have come up for consideration, but apparently nothing worthy of note was done in this matter.

On the invitation of Messrs. Babcock & Wilcox, Renfrew, the members of the Incorporated Municipal Electrical Association visited their works on Saturday. After inspecting the works they enjoyed a sail down the Clyde, and were entertained by the directors to dinner and tea on board. Unfortunately we had to leave the works before the inspection was through in order to catch an early train back to town; we therefore regret that we are unable to do more than notify the fact.

A noticeable feature of the Convention was the absence of the consulting engineer, but altogether Mr. Chamen and his colleagues can look back upon the Glasgow meeting with pride and pleasure from the social side, albeit municipal electrical engineering may possibly have derived but little advantage from the conference.

Our comments have been made in no spirit of carping criticism, but with the sincere and earnest desire that the Municipal Electrical Association may one day become a powerful society in the value of the information which its members undoubtedly possess, but which at present they do not seem able to freely impart to their colleagues in debate.

We congratulate the Association on a most successful reunion held under the most pleasant auspices in Scotland's greatest towns, and under circumstances which must have engendered the most cordial feelings of friendship towards "Scots wha' hae wi Chamen fed."

A word is due to the Association's permanent secretary, whose previous experience in similar work must be of great value, and whose quiet, unassuming way of carrying out his official duties, should have made him many friends.

CURRENT SPECIFICATIONS.

LXVIII.—DUDLEY EXTENSIONS.

SUMMARY.

Extent of Contract.—Supply and erection upon prepared foundations of one 500-KW. steam dynamo.

Division of Contract.—Separate offers are invited for engine and dynamo, distinct specifications being issued for each.

Specified Output of Engine.—To drive one 500-KW. dynamo when working condensing or non-condensing, and supplied with steam at 150 lbs. pressure, and to be capable of meeting prescribed tests, if necessary, with 140 lbs. steam pressure.

Specified Overload.—To give 100 per cent. overload for short periods, 50 per cent. for one hour, and 25 per cent. continuously with any steam pressure between 140 and 160 lbs.

Specified Speed.—Not to exceed 100 revolutions per minute.

Type of Engine.—To be preferably three-crank vertical compound slow-speed type, but alternative offers for other designs will be considered.

Type of Governor.—To be capable of adjustment by hand within 5 per cent. of normal speed whilst engine is running. To be of

approved type, controlling speed within 3 per cent. when whole load is removed, the momentary variation not exceeding 5 per cent.

Type of Emergency Governor.—An emergency governor to be provided, acting upon a supplementary stop-valve arranged to shut off all excess steam from engine beyond the amount required to run engine at normal speed under no load whenever speed exceeds normal by more than 10 per cent.

Position of Dynamo.—To be arranged tandem-wise at one end of engine.

Size of Fly-wheel.—To be of ample size to ensure steady running under the conditions of a traction load.

Specified Type of Dynamo.—To be of multipolar type, compound wound, arranged to give 500 volts under all conditions of load.

Specified Range of Regulation of Dynamo Voltage by means of Shunt Resistance.—By steps of 2 volts between 450 and 500 volts.

Conditions of Overload.—The dynamo to be capable of withstanding at constant voltage the overloads stated above without undue or injurious sparking, and to carry loads up to 750 KW. without the necessity of moving the brushes.

Maximum Permissible Voltage between Commutator Bars.—Seven volts.

Specified Steam Consumption.—A complete series of tests to be carried out after erection, at contractor's expense, to verify guaranteed steam consumptions under various loads, working both condensing with 24-in. vacuum, and non-condensing.

Specified Date of Completion of Contract.—Nine months from date of order.

Penalty for Late Completion.—1 per cent. of contract price for either section for each week late.

Specified Terms of Payment.—Up to 80 per cent. of value of work executed or plant delivered on site upon monthly certificates of the engineer, 10 per cent. within one month from date of completion for continuous effective usage, and 10 per cent. six months later.

Period of Maintenance.—Twelve months from date of completion.

Stipulations as to Removal of Foreman.—Satisfactory.

Stipulations as to Wages to be paid to Workmen.—Satisfactory. See comments below.

Stipulations as to Sureties.—Two to be named willing to be jointly and severally bound in sum equal to 20 per cent. of accepted contract.

Arbitration Proposals.—Satisfactory.

Date for Receipt of Tenders.—July 6th, 1901.

Mr. R. P. Wilson, the consulting engineer to the Corporation of Dudley, is responsible for the preparation of this specification. It will be noticed that contrary to usual custom, separate offers are asked for engine and dynamo, and that the conditions to be met by the combined set are very stringent.

Not only must the set be capable of working for periods of one hour at 50 per cent. overload and momentarily with 100 per cent. overload when working condensing with the higher pressure of 160 lbs. per sq. in., but from a paragraph on page 43 it is apparently also necessary that the set shall fill these requirements when exhausting to atmosphere and supplied with steam at 140 lbs. pressure. We think that the engineer in demanding such exceptionally severe tests and large margins is to a certain extent defeating his own object, and obtaining for his clients a larger plant than they ask for. The usual result of such large margins in the rated capacity of the units in a station is that the engineer-in-charge works the sets at more than their normal output, and so reduces the possible margin of power to accord with usual practice.

A rather curious clause states that while all tests on site are to be carried out at the expense of the contractor, if it is necessary to repeat the official tests, a payment of £25 shall be paid by the contractor to the Corporation to cover the expenses of the engineer or his representative in being present at the unsuccessful test.

A large number of guarantees as to steam consumption at various loads under different conditions of working and combined efficiencies have to be given, provision being made in the schedule for the combined efficiencies when working both condensing and non-condensing. It would be interesting to note what difference will be made by the engine builders in their guarantee of efficiencies whether working condensing or non-condensing.

The plant is to be in every way suitable for working with steam superheated 150° F. The permissible temperature rise of any part of the armature or field magnet windings after an *eighteen* hours' full load run is not to exceed 70° F. measured thermometrically, or 100° F. after one hour's run at 50 per cent. continuous overload.

The general conditions are on the whole of an acceptable character, complying in essential features with the model clauses agreed upon between the Municipal Electrical Association and the Electrical Plant Manufacturers' Association. The arbitration clause is unlimited in character. The labour conditions simply ask that all work carried out on site shall be paid for at local current rates, and that the usual hours of labour be observed, while the powers of the engineer *re* dismissal of foreman or workpeople may be accepted without the risks being unduly increased. The specified period of maintenance is 12 months from date of completion, the terms of payment provide for the last payment being made seven months after date of completion, but it is stipulated that upon receiving this last instalment, the contractor shall give an undertaking with security to carry out any work at his own cost, which may be chargeable to him under his maintenance guarantee.

LONDON COUNTY COUNCIL.

AT the meeting of the L.C.C. held last week several electrical matters received attention.

Municipal Electric Wiring.—The report of the Parliamentary Committee stated that during the last Session of Parliament they had received letters from several of the metropolitan local authorities asking the Council to seek legislation to empower those authorities supplying the electric light to wire premises and instal fittings, and to authorise them to obtain from the Council loans to carry out such works. The desire of the local authorities was to be thus enabled to provide wiring and fittings on a system of hire, or other easy terms of payment, which would result in the more general use of the electric light, especially in districts containing a large number of small houses. It appeared that the above-mentioned letters were received too late to be dealt with last session, and the committee had again been asked to seek those powers, by the Woolwich Borough Council, which pointed out that it would be of great assistance to be able to obtain loans for short periods to facilitate the installation of the electric light in that district. The views of the other borough councils on the subject were being ascertained, and the Finance Committee were of opinion that some such arrangement as that proposed was almost necessary to ensure the success of the London municipal electric lighting undertakings.

It appeared that the Woolwich Council proposed to make a charge to consumers for the use of electric fittings, and the Finance Committee consider that loans for the purpose might be granted by the Council for a short period not exceeding ten years. The solicitor advised that although it was not within the Council's spending power to promote legislation generally on behalf of local authorities, he thought the matter might be included in a General Powers Bill. Having considered all the circumstances, the Committee recommended the Council to authorise them to promote legislation for the purpose in question in the next session of Parliament, and this was agreed to without discussion.

Electric Supply in Bulk.—The Highways Committee submitted a report in reference to the conference which was recently held of representatives of metropolitan local authorities to consider the question of the supply of electricity in bulk. It appeared that with four exceptions all the London authorities were represented at the conference, which unanimously adopted resolutions expressing the opinion:—(1) That it is as essential to the interests of London as a whole that a purchase clause similar to that in the Electric Lighting Acts, which applies to defined areas, should also be made to apply to such companies as supply, or propose to supply, electrical energy in bulk to the whole or any part of London without regard to area; (2) that while preserving intact the rights of the local authorities with regard to electric lighting, it is desirable that the London County Council should be in a position to undertake, if it so determine and if so requested by the local authority, the supply of electrical energy in bulk for the convenience of any districts desiring to be so supplied, provided that the Council does not become competitive with the local authority; and (3) that it is desirable that the London County Council should draft a Bill on the lines of the clause suggested at the conference and submit copies for the consideration of the City Corporation, the Westminster City Council and the borough councils. The Committee expressed the opinion that it was desirable to take steps as soon as possible to give effect to the wishes of the conference, and the Council decided to instruct the Parliamentary Committee to prepare the draft of the Bill on the lines of the suggested clause for the consideration of the London local authorities.

New Generating Stations.—The Parliamentary Committee reported that the Bill promoted by the Notting Hill Electric Lighting Company sought to authorise the company to acquire lands at the rear of Addison Road and in Napier Road, Kensington, for the purpose of extending its generating station. It appeared that the Bill had passed through its final stages in the House of Commons without the County Council having been able to obtain amendments, and the Committee thought the Council's position should be safeguarded by a petition against the Bill in the second House. It was, therefore, decided to seal a petition for presentation against the Bill if it should be found necessary. The Council approved the action of the Building Act Committee in sanctioning the plans submitted on behalf of the Woolwich Borough Council for the erection of a generating station in White Hart Road, Plumstead Marshes. It

was also decided to approve plans presented by the Woolwich District Electric Light Company for an addition to the central station in Globe Lane.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be as brief and concise as possible. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.*]

"Lex" writes:—"A very interesting point has been raised with reference to a proposal to increase the salary of the city electrical engineer by paying him a commission on capital expenditure. The town clerk says that while it would be legal for the Corporation to make such a payment, it would be unlawful for the engineer to accept it, and I should be obliged if you would not mind answering the following questions in your "Legal Query Column": (1) Is it legal to pay a *bonus* on capital outlay to a salaried official? (2) Should it be illegal, why should it be illegal to receive any more than to give such a commission? (3) How would the recovery of penalties from the engineer affect his chances of further appointment?"

*** With regard to the first question addressed to us, we think that, having regard to the provisions of Sec. 193 of the Public Health Act, 1875, and the cases which have been decided thereon, it is *ultra vires* for the Corporation to pay their engineer in the manner suggested. The rule of law is that an engineer or other official must not be "In any wise concerned or interested in any bargain or contract made with a local authority." Now it is obvious that if a commission be payable on a sum which is to be paid by the local authority in respect of a contract over which the engineer must necessarily have some control, there might be a tendency for him to keep up prices. It is against public policy to put such temptation in the way of the engineer.

With regard to the second question, we cannot agree that it would be legal for the Corporation to pay an official by commission on contracts which involved expenditure of the ratepayers' money. In fact, there is distinct authority to the effect that in such circumstances application may be successfully made to the Court to set aside any resolution which provides for the payment of an official by commission. It is immaterial, moreover, that the Corporation term the payment a "lump sum," when in fact, the amount has been determined by percentage (see Reg. *v.* Ramsgate, 23 Q.B.D. 66).

With regard to Question 3, we are of opinion that, subject to the consent of the Attorney-General, an action for penalties could be brought against any engineer who accepted a commission in the manner suggested. Whether his having been convicted of such an offence would prejudice him in applying for a similar post on a future occasion, we cannot undertake to say. In any case, there is nothing in the Acts to render him disqualified by the acceptance of such a commission.

In view of the importance of the questions put by "Lex," we have dealt with them at greater length in another part of the present issue.

PARLIAMENTARY COMMITTEES.

Electric Traction on the Metropolitan District Railway.

The Court of Referees of the House of Commons sat on 19th inst. to consider various applications for a *locus standi* to be heard against the Bill of the Metropolitan District Railway Company to empower them to work the railway by electric traction.

Mr. Balfour Browne, K.C., who appeared for the Middlesex County Council, said that the County Council were apprehensive that damage would be caused by vibration to the County Hall at Westminster under which the railway passed. What they wanted was the insertion of a clause compelling the company to carry out the works in such a way that no damage should be caused. With the increase of speed there would be an increase of vibration, but he believed it was possible to obviate a lot of the vibration by having motors distributed throughout the train instead of having a locomotive.

The Court refused to grant a *locus*.

The London County Council and the City Corporation were granted a *locus* on the question of workmen's trains, construction and ventilation.

King's Norton and Northfield Tramways.

On 20th inst. the King's Norton and Northfield Tramways Bill, which has passed the House of Lords, came before the Unopposed Committee of the House of Commons. The Bill empowers the Urban District Council of King's Norton and Northfield to construct tramways and make provision in regard to tramways in and in the neighbourhood of such districts. It authorises various junctions to be made with tramways authorised to be made by the City of Birmingham Tramways Company at the boundaries of the district. A short tramway of 2 furlongs 1·5 chains was proposed to be constructed in the parish of Edgbaston in the city of Birmingham, joining with the existing tramways belonging to the City of Birmingham Tramways Company, but this was not to be done without the consent of the Birmingham Corporation. If the Corporation refused consent, then under certain conditions they were to make the line themselves and lease it to the District Council. Power is also given to take certain lands belonging to the Council situate at Lifford, in the parish of King's Norton, for the erection of an electrical generating station, and authority is also given to enter into agreement for running powers over the lines. The estimated cost of the scheme is £129,367, of which £108,206 is for the construction of the tramways, £15,000 for the generating station, and £6,160 for engineering expenses and general contingencies. The necessary formal proofs having been given, the Bill was allowed to pass through the Committee stage, and will in due course be reported for third reading.

Finchley and Hendon Tramways.

Lord Pirbright's Committee of the House of Lords on 17th, 18th and 19th inst. considered the Bill promoted by a company in conjunction with the Charing Cross, Euston and Hampstead Railway Company, to construct tramways between Golder's Green, Hampstead and Hendon and Finchley. The promoters were represented by Mr. Freeman, K.C., and Mr. Clode, and the Middlesex County Council, who were the principal opponents of the Bill, were represented by Mr. Pember, K.C., and Mr. J. C. Earle.

The proposals of the Bill, as explained by Mr. Freeman, were to construct two tramways from Golder's Green at a point where the proposed extension of the Charing Cross, Euston and Hampstead Railway would stop. One tramway would go to Hendon and the other through the Finchley district, eventually, it was hoped, to Tally Ho Corner. At present, however, owing to lack of agreement, the tramway would not go so far as Tally Ho Corner, although it was expected that an agreement would shortly be arrived at. The Charing Cross, Euston and Hampstead Railway were now authorised as far as Hampstead, but a proposal was before Parliament to carry it on to Golder's Green. Consequently, if the suggested tramways were constructed as well as the extension, it would give a continuous through route from Charing Cross to Hendon and Finchley. Counsel proceeded to point out the public advantages which would accrue from the construction of such a communication, and said large tracts of land would be opened up for building operations. It was intended to work the tramways on the overhead trolley system, and in connection with the service on the Euston, Hampstead and Charing Cross Railway. The ground of opposition by the Middlesex County Council was that the tramways in the county should be constructed and worked by the County Council.

Evidence having been heard for and against the Bill, the Committee decided to pass the preamble, subject to an agreement being come to with the Middlesex County Council with regard to purchase.

After consultation, Mr. Pember said the lease proposed by the County Council to be added to the Bill was as follows:—"The County Council of Middlesex may within a period of six months after the passing of this Act by a notice in writing under the hand of the clerk of the County Council require the company to transfer and assign to the County Council all their interest in the tramways and undertaking authorised by this Act and thereupon the company shall transfer and assign to the County Council all their interest in the said tramways upon the terms of the payment to the company of such sum as may be agreed upon or as may be settled in default of agreement by arbitration under and subject to the provisions of the Arbitration Act, 1889, as the amount paid by the company for the cost charges and expenses of and incident to the preparing and passing of this Act and from and after the date of such notice in writing all the powers and obligations conferred or imposed on the company by Sec. 6 and by Secs. 24 to 63 and by Sec. 71 of this Act shall be deemed to have been conferred or imposed on the County Council, and in those sections the word "company" shall be deemed to mean the "County Council." Then in Sec. 2 it was suggested that if the County Council should give notice Sec. 43 should be excepted. They were advised, however, that probably that would not pass the Standing Orders Committee. If Sec. 43 could not be excepted without danger to the Bill they would prefer to have it in. The Council were anxious to get the powers suggested in the new clause, and it would help them enormously with the Light Railway Commissioners, before whom they had proposed that service. If the Standing Orders Committee would not expunge Sec. 43 they must try and get rid of it in some other way.

Mr. Freeman said he was in a difficult position. If he was dealing with the County Council alone he would be in no difficulty, but before they could introduce the Bill they had to obtain the consent of the Hendon District Council, and he was afraid they would come to the other House and say that the promoters had made an arrangement with the County Council behind their backs, and that their consent had been obtained when the circumstances were very different. If the Committee considered that Mr. Pember's proposals were fair and reasonable, he would take no part in objecting. He thought, however, the County Council should obtain the consent of the Hendon Council before the Bill came before the next House, although it seemed to him that Hendon could have no reasonable objection to the arrangement.

The Chairman: You submit tacitly, but do not acquiesce.

Mr. Freeman: I would put it that I have no criticism to offer on the proposals put in.

Mr. Pember said he must take the risk of the House of Commons' Committee rejecting the proposals. He could not undertake to get

the consent of the Hendon Council first, because the House of Commons might say they would not allow the petty jealousy of Hendon to stand in the way of such a public benefit, but he would give Hendon notice, for they would undoubtedly have the right to petition against the Bill in the Lower House.

The CHAIRMAN said the Committee would accept the view of Mr. Pember.

The new clause was then added to the Bill, and the other clauses were adjusted, and the Bill ordered to be reported to the House.

LONDON UNITED TRAMWAYS.

On 19th inst., Lord R. CECIL, K.C., addressed the Committee in opposition to this Bill on behalf of several frontagers. He contended that the construction of a tramway along the proposed route would tend to damage the value of residential property, and as no public necessity had been shown for the line, he asked the Committee to reject the scheme.

Witnesses were then called to bear out counsel's contention, one —the Rev. Mr. KITSON, rector of Barnes—saying that he had not heard a single voice in the district in favour of the tramways, everyone opposing it most strongly.

Mr. MOORE next followed on behalf of the London County Council, who, he said, objected to that part of the scheme which touched the County of London, because the Council were the tramway authority within the area, and they protested against any private company being allowed to construct tramways. At present the L.C.C. owned 74 miles of tramway out of 115 miles authorised in the County of London, and in a couple of years' time—in 1903—practically the whole of the tramway system in the county would come under their control.

Mr. J. W. BENN, chairman of the Highways Committee of the L.C.C., gave evidence as to the position of the company in regard to tramways in London, and said that if, in the opinion of the local authority, extensions were necessary in Hammersmith or Wandsworth, the council would be prepared to make them, as their desire was to extend the tramway system of London as much as possible. They never objected to the introduction of electrical working, but they contended for a voice in settling what particular form of traction should be employed. He had no objection to a tramway being carried over Hammersmith Bridge, but if it was made he considered it should be worked by the L.C.C.

Replying to the COMMITTEE, Mr. BENN said that if the promoters were prepared to consent to the piece of line over Hammersmith Bridge to fall in to the Council with other spurs in 1909, he did not think the Council would oppose the scheme.

The CHAIRMAN said he thought it would be well to get that point settled before the Committee proceeded any further, and the proceedings were, therefore, adjourned to see whether some arrangement could be come to with the County Council.

At the meeting of the Committee on 20th inst., Mr. MOORE stated that the arrangement which it was hoped might have been come to between the London County Council and the promoters with respect to the proposed line within the County Council area at Hammersmith had come to nothing.

Several witnesses were then called on behalf of the frontagers objecting to the Barnes and Richmond section of the tramways.

The MAYOR OF WANDSWORTH was called by Mr. Vesey KNOX, and said that the metropolitan Borough of Wandsworth were not opposed to the tramways, but they considered it important to have through routes under one arrangement to all parts of the borough and to the centres of London. Consequently he did not think that the suggested tramways would be of much use to them. They thought the London County Council were the proper authority in whose hands the tramways should be. Further, he noticed that under Clause 30 of the present Bill, the company might reconstitute themselves with any capital it might think fit, and therefore they did not really know who they might have to deal with in the future.

Mr. BALFOUR BROWNE, K.C., proceeded to sum up the case for the promoters, and referring to the objection of the London County Council to the company's line at Hammersmith over Hammersmith Bridge, said that that was simply a link between the company's existing system and Surrey, and it was no part of a great London system of tramways. They did not object to the L.C.C. making the Hammersmith portion of the line on condition that the company were granted a lease of it for 25 years, or they would agree that the company should make it themselves and hand it over to the County Council in 21 or 25 years. He believed that the only reason the Wandsworth Corporation opposed their scheme was because the company would not give them an additional £20,000 towards the cost of street widenings.

In answer to the CHAIRMAN, Mr. BALFOUR BROWNE said that they were anxious to construct the line from Hammersmith Bridge, and they would be prepared to give it up to the L.C.C. at the end of nine years, when the other tramways in London would be acquired by the London County Council.

The CHAIRMAN said the Committee were prepared at this stage to declare that the preamble of the Surbiton group, crossing Kingston and Hampton Court Bridges was proved, excepting in respect of the proposed line passing in front of Miss Shrubsole's house. The Committee were of opinion that the widening of Kingston Bridge should be coincident with the laying down of the tramways, and they hoped that this might be done without destroying the beauty of the bridge, which brought them to the Bath Road. In view of the fact that both the promoters and the Middlesex County Council had declared their intention to bring a scheme before the Light Railway Commissioners for a through route, including that portion of the Bath Road, the Committee left that matter to the decision of the Light Railway Commissioners and would not give the powers sought under the Bill, it being clearly understood that it was the wish of the Committee that the promoters should not be prejudiced before the said Commissioners by this decision. The preamble of the Bill in regard to the tramway from Kew Bridge to Richmond would be declared proved, and in regard to the tramway from Richmond to Putney, and the line along Bridge Road and Raneleigh Gardens up to Hammersmith Bridge not proved. The Committee were prepared to give powers to the promoters to construct their tramway from Kensington Road over Hammersmith Bridge, subject to conditions of reverter to the London County Council in 1909 on reasonable terms, and the Committee asked that an arranged clause should be brought up to that effect.

Mr. BALFOUR BROWNE then addressed the Committee with respect to the opposition of the Metropolitan Water Companies, who wished for special protection in respect to electrolysis, and he urged that ample protection was afforded by the model clause contained in the Bill.

On 21st inst. the Select Committee of the House of Commons continued the consideration of the question of the claim of the water companies for their protection against electrolytic action.

The CHAIRMAN said he thought he gathered from Mr. Balfour Browne's opening remarks that the existing protection under the clauses of the Bill was sufficient, and if not, the Board of Trade had full power to adapt these to new discoveries.

Mr. BALFOUR BROWNE: That is so.

The CHAIRMAN: And the water companies, if they find they are affected, have the right of appeal to the Board of Trade.

Mr. BALFOUR BROWNE: Most assuredly. They can go at any time to the Board of Trade and say: "Here, under the regulations, electrolysis is taking place."

Prof. SILVANUS THOMPSON, past-president of the Institution of Electrical Engineers, and practising for many years as a consulting engineer, was the first witness called, and said he had considered questions arising from the effect of electric currents flowing in the conductors and of those flowing from one conductor to another. He had a familiar knowledge with the circumstances under which electric currents would, flowing out or into the metal conductor, produce corrosion and other chemical changes, and the chemical action due to the flowing of the electric current was called electrolysis. To produce any electrolysis at all, the electric current must pass out of the metal conductor into some liquid or into moist soil, or it might also produce a different chemical action on flowing back. It might carry away metal where it left metal for the moist soil, or it might produce a deposit, on the contrary, when it went back into the metal. Corrosion or solution of metal only occurred at the surface of exit. At the surface of re-entrance instead of solution or corrosion there was a tendency to produce a deposit. Electro-plating furnished an example of useful electrolysis, for in the electro-plating vat deposit occurred of silver, copper or other metal in solution on the surface of re-entrance; while at the surface and exit or anode, where the current left the metallic conductors to flow into the liquid at the vat, there was corrosion. Action of that kind on metal pipes could be prevented by putting a conductor in all the water pipes near the generating station. If a chief meter main came near the generating station, they would have to make a metallic connection with a good copper bond and communication to the returning station.

Mr. BALFOUR BROWNE: In a place where an electric current may be leaving an island tramway rail embedded in moist soil, what effect would a current of 1 ampere produce in an hour?—Under the most favourable circumstances, it would remove about 15 grains of the iron.

Continuing, WITNESS said that it would be the maximum, but the nature of the soil had a great deal to do with it. Saline water formed a better conductor than ordinary fresh water, and the figure he had given of 15 grains he certainly would not expect to find in any tramway rail. Witness exhibited glass tanks filled with moist sand with pipes in them subject to electric currents, to illustrate his evidence. He showed that where there was a metal bond uniting the pipes there was no corrosion, and *vice versâ*. There were three courses open to the engineer to lower the possible drop of potential. One was to reduce the resistance of the rails as low as possible by using a rail of sufficiently great cross section, another was to provide "return feeders," which would carry back from definite distant points of the rails much of the current, and a third was to apply a "negative booster" to automatically suck away the returning current, which would otherwise cause a drop of potential and tend to originate stray currents. The Board of Trade regulations said there was never to be a greater difference of potential than 7 volts, and the other regulations of the Board of Trade amounted practically to this, that although a 7-volt fall of potential may be allowed on the system as a whole or something not exceeding that there must not be a greater drop on one mile of length than something a good deal less than seven.

In replying to the CHAIRMAN as to whether they would have to put a conductor into the water pipes near the generating station, WITNESS said that the chief main at some place where it came near the generating station they would have to make a metallic connection on to the water pipe with a copper bond which would carry the return current straight back to the station.

Mr. BALFOUR BROWNE: I will ask you one general question. Have you been able to discover any electrolytic corrosions in pipes in connection with tramways which are worked under the Board of Trade regulations?—I know of no case.

In your view, as a matter of very great experience, are the Board of Trade regulations sufficient for the protection of the water companies?—I think they are.

Mr. PEMBER: You say you do not know any instance of electrolysis in a case where anything in the nature of a tramway like this is working under the Board of Trade regulations. Let me ask whether you have heard of one instance in the Clapham Road where a gas pipe was found corroded away lately owing to the action of the currents of the South London tube railway?—You are speaking of a railway tube, and not a tramway on the surface.

Mr. BALFOUR BROWNE said the regulations were not the same.

Replying to further questions, WITNESS said that if the tramway company damaged the water company's pipes in any way outside the Board of Trade regulations, they would be responsible at common law to make it good by compensation or otherwise.

Sir WM. H. PREECE was called by the promoters, and in answer to Mr. LOUIS COWARD, said he had devoted considerable attention to electrical disturbances in the earth for the last 40 years. There were always electric currents flowing through the earth, sometimes varying in strength, but always a source of disturbance. They sometimes acquired very great magnitude indeed, especially when there were sun spots—when there were disturbances in the sun. There were certain periods when they had the Aurora Borealis in the Northern regions that they had great disturbances of their magnetic compasses, and when they had the crust of the earth full of electricity it found its way through all the telephone and telegraphic wires when they used the earth. The consequence had been that he had known the whole of the telegraphic service of the country broken down through the presence of these earth currents. It was, however, easily distinguishable how far its effects were due to natural earth currents, to atmospheric electric currents, to induction, or to electric influence. In pursuance of the recommendations of Lord Cross's Joint Committee, the Board of Trade made regulations, dated 1894, which the Committee had before them. His opinion was that the Board of Trade regulations were sufficient if they were carried out, and at the present moment they were not always carried out. The number of visits, as given by Mr. Trotter and Sir Courtenay Boyle, showed that they were not properly carried out, and he held very strongly that these regulations should be properly carried out, and that official visits should periodically be made over the country. He had discussed the matter with Sir Courtenay Boyle, but he objected to it very much because he was afraid it would add very much to his staff. He, however, thought that with the present state of tramways in the country, one additional inspector to Mr. Trotter's staff, and in a few years a second inspector, would be all that was required to see the rules and regulations carried out. The water companies could by simple tests determine whether the regulations were being complied with or not; and then the rules and regulations were elastic, and the Board of Trade were always ready to listen to any defect there might be in the regulations.

Mr. COWARD: And it is quite open to anyone who feels aggrieved to lay their special circumstances before the Board of Trade with the view of obtaining a modification should it be necessary?—Certainly.

You agree with the evidence which has been given that with regard to this electric corrosion, if the current flows into the pipe there is no corrosion?—There is no question about that.

Continuing, WITNESS said there were several remedies for electrolysis. The first was rather a drastic one. It was to connect all the pipe systems, water and gas, together—to bond the lead joints they had heard so much about. But that in the present day with the thousands of miles of pipes in London was quite out of question. In any new undertaking he thought the gas as well as the water companies would see the advantage and the necessity of making perfect joints, and they were now using lead in their joints, which made, he thought, a perfect joint. In fact, in the water systems he knew it was a perfect joint, for the tests they had made in the Post Office showed that there was absolutely no fall of potential—in fact, the potential of the earth system was absolutely zero. That was one system, but he thought it was impracticable and must be put out of consideration. The second system was the connection of this mass to the negative pole at the power house. It was done in America to a very large extent, and he believed it was done in this country. The third remedy was that adopted by the Board of Trade, and that was the reduction of potential to a drop of seven volts. That seven volts was adopted by the Board of Trade on the suggestion, he believed, of one of the representatives of the water companies. No company had ever found the smallest difficulty in meeting this, and in fact as a rule the drop of potential was very much less that 7 volts, and if he were asked he would say that the Board of Trade might very readily reduce the drop to 5 volts. A fourth remedy had been mentioned by Prof. Thompson, and that was the direction of the current. It was not a difficult thing to change the direction of the current, and it was done with a booster. Then there was another certain cure for all these troubles, and that was the use of alternating currents. There was no disturbances of this kind with the use of alternating currents, but with the present experience the use of alternating current on tramways was out of the question. Lastly, the whole principle which underlay the maintenance of all industries, whether electrical or anything else, was to carry out the doctrine of prevention better than cure. They did not want to wait until pipes were corroded to cure the cause of the corrosion. It was periodical testing and examination of records which had enabled them all these years to maintain the electrical systems of the Post Office in the state of perfection they were in, and he thought himself it was the duty of the water and gas companies to study their tests and make use of them as much as they possibly could. The amount of damage which could take place if the Board of Trade regulations were carried out was so small that it would take 10,000 years to corrode a hole thorough an iron main pipe.

The CHAIRMAN said the impression which had been made upon the Committee, was that there was some danger, but as to how much was entirely speculative. They might have experts on either side give much evidence as to whether it would occur in 10,000 years or might occur at any moment. It seemed to him an inquiry which might be pursued *ad infinitum*. He would ask Mr. Pember, as a practical point, if what he wanted was the Board of Trade regulations strengthened.

Mr. BALFOUR BROWNE said that if the water companies could prove that to the Committee, they could have proved it to the Board of Trade, but they had failed to do so. They could, however, go to the Board of Trade now.

Mr. PEMBER said it was not in the power of the Committee to strengthen the Board of Trade regulations, but there was one thing which several Committees had done, and which had been done voluntarily by other promoters, and that was, at all events, to give a compensation clause to the water companies if they showed that they had suffered damage.

Mr. BALFOUR BROWNE said he should resist that.

Mr. H. F. PARSHALL, M.I.E.E., was then called, and said he had advised in connection with the Central London Railway, the Dublin United Tramways, the Glasgow Corporation Tramways, the Bristol Tramways, and other works. He was the consulting engineer to the London United Tramways Company. They had been working at Bristol for seven years strictly under the Board of Trade regulations. Records were kept and showed that since the tramway was opened they had not gone outside the Board of Trade regulations, and as to the gas and water pipes and their own cables, there had been no electrolysis. He might say that if their cables were subject to electrolysis, they would have to shut their installation down, and there was absolutely no evidence of electrolysis in any part of their works. They had had over 100 miles of tramways working in Dublin for several years, and had generated about 20,000,000 Board of Trade units, which would correspond with 40,000,000 ampere-hours, and there was absolutely no suggestion of electrolysis. The cables for working the tramways were laid parallel with and near to the rails, and sometimes between the rails. In the first place they were iron-armoured, inside of which they were lead-sheathed. That iron armouring or lead sheathing was comparable with the gas and water pipes, and these cables were generally nearer the metals than were gas and water pipes, and yet they had suffered no deterioration. He believed in this country he was responsible for about £500,000 worth of cables laid down in this way, and in no case had they found electrolytic action. In Dublin their cables were laid near the gasworks, where there was a considerable amount of ammonia in the earth. They became apprehensive that there might be trouble, and opened up there, and took the cables out, and found them as bright and clean as when they put them down. In Bristol there had been three separate and distinct investigations for electrolytic action, and there was no suggestion of any discovered.

By the CHAIRMAN: £50,000 would have to be spent on the system to make it comply with the Board of Trade regulations, and that was in no sense necessary for efficient working.

Mr. JOHN SALTER, A.M.I.E.E., said he was assistant engineer in connection with the extensive system of tramways in the West of London, and during his connection with the London United Tramways Company he had given special attention to the subject of leakage currents. He conducted experiments in the Chiswick Road, before the tramways were being worked, to find out what ordinary earth currents were going about in the road. Before the tramways were worked by electricity, it was desired to impose on them some stringent conditions with regard to the drop on the rail that existed under the Board of Trade regulations, but they made tests when working with horse traction, and they found that all the rails from Kew Bridge to the power station had a current of 15 amperes—ordinary earth currents, which gave a considerably greater drop on the rails than it was endeavoured to impose upon them by the Kew authorities.

Mr. STEPHEN SELLON said he had large experience in the construction and working of tramways, and about 250 miles of tramways were being worked under his control or supervision in about 30 different systems. He had come to the conclusion that if a compensation clause was inserted as in the Sheffield case, it would have a serious effect upon tramway enterprise. The Sheffield clause was:—"If it be proved that any injury or damage to the mains, pipes, or apparatus of the Sheffield United Gas Light Company shall have resulted from fusion or electrolytic action caused by any current generated or used for the purpose of electric traction on any of the tramways for the time being belonging to the Corporation, nothing in this Act shall relieve the Corporation from any liability to make compensation." He did not think any further protection was needed for the gas or water companies than that given by the Board of Trade regulations. They were constantly looking for cases of electrolysis and had never found one.

By Mr. PEMBER: He knew that the promoters of the Finchley and Hendon Tramways had accepted the Sheffield clause, and he took it that was due to the fact that speculative Americans had come over and would clear out when they had finished, leaving the result to others.

This concluded the case for the promoters.

Mr. PEMBER, for the water companies, then called Prof. AYRTON, F.R.S., Past-President of the Institution of Electrical Engineers, who said he did not think the Board of Trade, with the best of wishes, had succeeded in giving effect to the recommendations of the Joint Committee with regard to leakage currents.

Mr. PEMBER asked if this opinion was based on the absence of anything in the regulations which prohibited the electric tramway

or the electric railway from sending large electric currents through pipes.

Witness said that was so. The Board of Trade made certain regulations, to which reference had been made that day, but in one case a mistake was made. Secs. 6 and 7 dealt only with what electric pressures might be set up, and in only one case did they refer to the current, and that was to say the current must not exceed two amperes per mile of single tramway. He was not sure whether the Committee realised that that was merely the maximum current they might return, and it was in no sense a limit of the current a tramway might send into a pipe. All it said was that the electric pressure between the two ends of the rails must not exceed more than a certain value—7 volts.

Mr. Pember said they knew that it had been maintained by the promoters of the Tramway Bill that if the rules about electric pressure were complied with it would follow that the current would be small, and, therefore, the electrolytic action, if any, would be a negligible quantity. He would like to know what Witness had to say to that.

Witness replied that it had been held that if the maximum pressure between the rails was kept down to 7 volts, it was quite impossible that large currents should be produced in gas or water pipes, and it was regarded as specially ludicrous that they could occur if the electric traction system were a tubular railway 50 ft. below the gas pipe. For that reason they were led quite recently to make an experiment to a pipe in 193, Clapham Road. In spite of the Board of Trade regulations, and in spite of the pressure in the afternoon not reaching more than 4 volts, as shown by the continuous record required by the Board of Trade, they had the result that between four and five in the afternoon the current went up to 10 amperes. That made it certain that the Board of Trade rules when fully carried out did not prevent necessarily large currents flowing into gas and water pipes when the traffic was large. He felt sure from the experiment that this was due to the running of the railway, because it disappeared when the trains stopped. He did not concur in the evidence put forward by the promoters that there was no instance of electrolytic damage being caused where the tramways had been worked under the Board of Trade regulations. Prof. Perry and himself had openings made at Liverpool, and investigations were made with regard to two gas pipes in a street where electric trams had been running since November, 1898; it was shown that although one pipe was laid in August, 1899, they were both affected by electrolytic action. It might be quite true that there was not evidence of electrolytic removal in the steel of the tram rails, but it was absolutely no evidence whatever that the current was not leaving the rail for another pipe. He maintained that iron might be eaten away if laid in sand moistened with saltish water, even when the presence of the electricity was far less than that allowed by the Board of Trade.

The Committee sat again on Monday, when Prof. Ayrton was recalled with reference to the statement that considerable currents were found to flow in pipes miles away from electric tramways. He said that since Friday he had gone into the matter thoroughly, and started testing the current in the rails of the electric tramways at Chiswick at 10 a.m. on Saturday, and went on continuously testing till 4 a.m. on Sunday. While the tramways were running the current was large—30 to 40 amperes in the four rails. As the traffic died away and the company stopped running, the current in the rails diminished. The currents they found on Sunday were absolutely constant, but hour by hour they diminished. Natural currents did not remain steady.

Prof. Perry was called, and bore out the statements of Prof. Ayrton, and said that when the Board of Trade regulations were framed it was in view of great electric resistance in the joints of gas and water pipes. The real danger was at the joints and the jumping off of the joints, and that was a very serious thing indeed.

Prof. Dewar was briefly examined, and generally endorsed the evidence of Prof. Ayrton. He said there was no absolute prevention of leakage, and they could only diminish the cause of the flow as much as possible. For the water companies to prove that the electrolytic action was due to the running of the tramways would mean the tramway companies suspending their operations for a certain time.

Mr. Pember, K.C., then addressed the Committee, and contended that the Board of Trade had not sufficient power to deal with the matter, inasmuch as that the recommendation of the Joint Committee said there should be either insulated returns or uninsulated metallic returns of low resistance.

The Chairman asked if that was not sufficient.

Mr. Pember said it was under that particular part of the clause that mischief had arisen.

The Chairman: What return do you want?

Mr. Pember said they wanted an insulated return, but the clause gave power for an insulated return or an uninsulated return of low resistance. The next point he wanted to insist upon was that their knowledge of electrolysis was nearly all subsequent to the sitting of Lord Cross's Committee. It was true the water companies were there, and that Prof. Dewar, who with an insight into the future which was truly scientific, prognosticated that a great many evils might result. But the water companies took really little part in the Committee. The inquiry was really raised as between the telephone and the tramway companies. With regard to the water companies, their mains were in the ground and they could not carry them elsewhere. More than one tramway company had submitted to an absolute compensation clause, and he asked for such a clause in that Bill.

Mr. Balfour Browne having briefly replied,

The Chairman announced that the Committee found the preamble of the Bill proved with regard to Clause 12.

The other clauses were then gone through and Bill ordered to be reported.

Clyde Valley Electric Power Bill.

On 20th inst. the Clyde Valley Electric Power Bill was before the Examiner in the House of Lords for proof of Standing Orders. It was found that the Standing Orders of the House had not been complied with, and accordingly the Bill will have to go before the Standing Orders Committee, and a petition presented for the suspension of Standing Orders.

Roundhay Electric Lighting.

The electric lighting provisional order to the Roundhay and District Electric Light Company, Limited, in respect to the township of Roundhay, in the rural district of Leeds, in the West Riding of York, which was one of the orders in Provisional Order Bill (No. 7), came before Lord Pirbright's Committee of the House of Lords on 19th inst. Mr. Wedderburn, K.C., and Mr. Charteris appeared for the promoters, and Mr. Pember, K.C., and Mr. Vesey Knox for the Leeds Corporation.

Mr. Wedderburn said the electric lighting company was incorporated last year with a capital of £20,000. Roundhay was a township adjacent to Leeds, but was entirely independent of it. The cost of the works proposed under the order was about £19,000, and the only opposition was that of the Leeds Corporation. What the Leeds Corporation wished to do was to look into the future and furnish themselves with an argument which might be used if at some future time they desired to extend the city boundaries and include Roundhay. He contended, however, that no Committee would listen to that as a reason why Roundhay should not have electric lighting now. Leeds supplied Roundhay with gas, but the reason for that was because the Leeds Corporation bought out the gas company which supplied both places. The Leeds Corporation now supplied Roundhay with water, and they now asked that clauses should be inserted in the present Bill to empower them to purchase the mains and pipes of the electric lighting company, should Roundhay ever be merged into Leeds.

Mr. Pember, K.C., argued that Roundhay was only a suburb of Leeds where business people engaged in Leeds resided. It was impossible for the company to supply electricity without competing with the gas supply of the Corporation. Of the 1,482 acres of Roundhay 675 were absolutely owned by the Leeds Corporation, and they objected to the company coming upon their estate.

The Committee said the only *locus* possessed by the Corporation was that of a private owner, which would only relate to a damage.

Mr. Pember contended that they had the right to ask that the company should be excluded from the Corporation's estate.

In reply to the Chairman, it was stated that the Board of Trade had refused to grant a *locus* to the Corporation.

The Committee decided that argument against the order must be confined to showing any damage the Corporation would sustain over and above that for which it was entitled (under the General Act) to compensation for damage to their property.

Under these circumstances Counsel for the Corporation thought there would be no good purpose served in further occupying the time of the Committee.

An application was made for costs against the Corporation, but this was refused.

The Bill was then referred to the Unopposed Committee.

Notting Hill Electric Lighting Company.

The Bill of the Notting Hill Electric Lighting Company, which has passed through the House of Commons as an unopposed measure, passed the Examiner of Standing Orders in the House of Lords on Friday. The Bill authorises the company to acquire certain lands in connection with the extension of their generation station.

Clydebank Tramways.

The Clydebank Tramways Bill which comes under the Private Legislation Procedure (Scotland) Act, 1899, passed the Examiner of the House of Lords on Monday. It authorises the local authority to make and maintain tramways within the borough, and work them by electric traction.

Metropolitan Electric Supply Company.

The Bill of the Metropolitan Electric Supply Company came before the Examiner of the House of Lords on Monday, and standing orders were found to have been complied with. The Bill seeks power to enable the company to lay a second set of mains through Willesden, Hammersmith, Kensington and Paddington in connection with their generating station at Willesden. Clauses are included for the protection of local bodies.

Central London Railway.

On Tuesday the Central London Railway (No. 2) Bill came before the Examiner of the House of Commons, and Standing Orders were found to be complied with. The Bill is to amend Sec. 4 of the Central London Railway Act of 1899, and to authorise the raising of further capital and other purposes. Power is given to take certain lands in the parish of Hammersmith to improve the access to Shepherd's Bush Station.

BLACKBURN CORPORATION BILL.

ON Monday the Omnibus Bill of the Blackburn Corporation came before the Examiner of the House of Lords, and further Standing Orders were found to have been complied with. The Bill authorises the Corporation to reconstruct existing tramways, and to construct additional tramways. It also gives power for the construction of an electricity generating station on lands used for gasworks, and power to supply fittings, &c., for electric light. Power is taken to spend £199,000 on tramways and £10,000 on the electric light undertaking.

ECCLES CORPORATION BILL.

THE Eccles Corporation Bill passed the Examiner of Standing Orders of the House of Lords on Monday. The Corporation takes power under the Bill to construct additional tramways and reconstruct the existing tramways within the borough, and to use land now used for sewage disposal for the erection of an electricity generating station, with the consent of the Local Government Board. The Corporation may supply electric motors and apparatus for the use of electricity for motive power and other purposes.

LONDON'S UNDERGROUND RAILWAYS.

AT the resumed sitting of the Committee on Tuesday last week, Mr. CRIPPS continued his evidence and dealt largely with the question of cheap trains, and submitted a clause on behalf of the L.C.C. which, he said, would be proposed for the acceptance of the various companies. The clause provided that workmen should be allowed to travel by all trains reaching their destination before eight o'clock in the morning. The London County Council would, he said, be glad to have the Charing Cross and Hampstead line constructed, and thought it would be an advantage if that line were extended to Golder's Hill. In cross-examination, Mr. Cripps said that he did not put forward any scheme for giving financial assistance to any of these companies. The matter had never been under the consideration of the London County Council. The policy of the Light Railways Act represented a very considerable advance in giving assistance by local and municipal credit in the construction of light railways which were needed for the benefit of the public. With regard to the tube railways injuring tramway enterprise, he said that he believed that the reverse was the case, and as a matter of fact, the City and South London line had helped the County Council's tramway traffic on the south side of the Thames, as it was found that the two undertakings had been mutually helpful to each other.

By Lord KNUTSFORD: He agreed that circumstances had greatly changed since 1883, when the Cheap Trains Act was passed, and it was very desirable that it should be amended in some particulars, but he hardly thought it would be better to have another cheap Trains Act instead of having separate clauses introduced into the various private Bills with the object of providing workmen's trains. He thought there would be much greater difficulty about getting a new general Act passed than there was in making arrangements between a body like the London County Council and the various individual railway companies when they came to Parliament.

Further replying to the Committee, WITNESS said that the London County Council were strongly of opinion that through tickets should be issued. In their opinion the workmen of London could afford to pay 1s. per week, that was 2d. per day, for living out of London, and for that sum they should be enabled to get a through ticket. His own personal view was that the system of underground railways should be completed by means of money raised on the most economical terms, and that a guarantee might be given for a sort of limited dividend, and that the difference might be shared by those who worked the railway, and who found the money, and the ratepayers by whose credit and assistance the money was provided. The object for which the tube railways were to be built, was, of course, a complete reversal of the ordinary idea of constructing railways, for whereas as a rule, railways were made to accommodate the traffic, in this case they were to be made with the view of making the traffic for themselves. He agreed that if all the limitations which were desirable in the public interests were imposed, it might make it very difficult to raise the necessary capital in the ordinary way without municipal assistance. There were many members of the L.C.C. who were in favour of a purchase clause being inserted in the Bill, but personally he rather doubted whether a purchase clause in the Bill would meet the case, as he was afraid that would make the raising of the capital more difficult. When that was tried in the case of the Electric Lighting Act of 1882, it made the raising of capital impossible, with the result that we were very much behind the rest of the world in electric lighting undertakings. If coupled with the purchase clause, there could be some guarantee which would enable the capital to be raised, this difficulty would be got over. He doubted the practicability of finding the necessary capital to make more than one or two of the proposed lines at the present time, and he was afraid that the result of authorising more than one route would be that probably they would get none. He was not aware that the County Council had ever considered the desirability of forming a kind of trust for the railways of London. They were endeavouring first to deal with the water question, which was more urgent than railways. He did not see why the County Council should not make lines and work them themselves, although he was afraid that public opinion at present was hardly ripe enough to accept such a suggestion.

Mr. GEO. PAINTER, chairman of the Streets Committee of the City Corporation, to whom the subject of various proposed underground railways had been referred, said that generally speaking the Corporation agreed with the evidence which had been given by Sir Alexander Binnie and Mr. Cripps on behalf of the L.C.C., but they wished to reserve their right to consider each Bill in detail as they came before the Committee, and they also wished to have a free hand as regarded the question of sites for the stations, which they considered most important.

Mr. E. HARPER, the statistical officer of the L.C.C., submitted a mass of statistics with reference to the population in London, with a view of showing the need that existed for increased railway facilities to take the workers into the suburbs.

The Committee then adjourned.

At the sitting of the Committee on 21st inst., Mr. ROGER WALLACE said that as representing several electric lighting companies who wished to obtain provisions for supplying electricity in bulk for the purpose of electric railways, he would like to ask the Committee whether they would deal with the subject as a whole, or separately.

The CHAIRMAN said that that matter would have to be dealt with in each separate Bill.

Mr. CHAS. BOOTH, who has written several works on the condition of the poor in the East End of London, gave evidence as to the desirability of increasing the train service of London, with a view to remove the present congestion in certain districts. He said that London was not so well supplied with means of locomotion as many cities, not only in America, but also some of our provincial towns. In any scheme for taking the people out to the suburbs, he regarded unity of plan as very important indeed to get the full value for those undertakings. He would like to see a complete scheme of tube railways covering the area around London, and that would get rid of the congestion which now existed in many districts. He regarded electric traction as immensely superior to any other means of locomotion. The policy that had been pursued of insisting upon very onerous conditions with regard to re-housing when railways had to buy lands to widen their lines or to construct stations, had been, in his opinion, against the public interest. He thought that it would be very much better to faciliate the operations of railways in every way, and he thought a better bargain might be made with them in the interests of the public than by insisting upon their re-housing the persons they displaced. As to the introduction of electricity on to the District Railway, he said he supposed the circle would in some way be kept distinct from the outer extensions, and what was really wanted was that there should be an inner circle of really fast, and a constant succession of, trains enabling anyone to get from one part of London to another. With quick electric service he thought that the inner circle should be of immense value, and that it would prove a feeder for the outer line. As regarded the question of cheap fares, he believed that their adoption would prove most profitable to the companies as well as most advantageous to the public. He should suggest a uniform fare irrespective of distance. He believed in New York they had a uniform 5 cent fare which had to be paid whether a person wanted to go a few hundred yards or several miles.

The CHAIRMAN: But you must have some limit.

WITNESS replied that that was so, but he would go a very long way in respect of a uniform fare. Under such a system they might carry some people a longer distance than was profitable, but on the whole he believed the result would be profitable to the companies. His idea was that the various tube companies should interchange tickets, and that a 2d. system for the whole of London would be both remunerative and practical. In addition, there might be be special fares for workmen in the early morning. With regard to the locomotion on the surface of the streets, he would like to see a system of electric tramways going further out into the country in connection with tube railways. In his opinion those electrical tramways should cover the same ground as the omnibuses now covered, and he did not think London would ever be properly served unless the omnibuses were superseded by electric trams. He thought that there might be two central authorities constituted to deal with tube railways—one the municipality, which he thought where necessary should be able to take the initiative in constructing such railways; and the other should be a controlling authority.

By Sir JOHN DICKSON POYNDER: He agreed that such control as he suggested might militate against the raising of capital for the construction of these underground lines, but if it prevented steps in a wrong direction, then it was not to be regretted. Personally, he thought that the increased facilities for travelling in London were bound to go forward, and they could afford to put a little drag on in some instances.

Questioned by the COMMITTEE as to what he thought would be the result of a purchase clause being inserted in the Bill, WITNESS said he was afraid that such a clause would entirely stop private action, as it had, to a large extent, in the case of electric lighting undertakings years ago. In his opinion, before consent was given to any of the Bills now before the Committee, a complete scheme of locomotion should be laid down. The L.C.C. was by far the best body to undertake a large scheme of extension of locomotion of all kinds, especially with regard to surface electric tramway work, and he should also say that the L.C.C. was the best authority to construct the tubes. He thought it was essential that the tubes should run right through London, and not stop in the centre. He admitted that there might be some difficulty in arranging for a through fare for all the railways, but he thought that the ingenuity of business men could devise some satisfactory pooling arrangement which would be fair to the various companies. A permanent joint committee of members of the House of Lords and Commons would, he should think, be the best controlling body.

In cross-examination by Mr. LITTLER, K.C., WITNESS said that if private enterprise shrunk from providing the capital, then public enterprise would have to take it up.

Col. YORKE, chief inspecting officer of railways at the Board of Trade, said he had been requested by that department to give evidence before the Committee. He had had a considerable experience with tube railways, because he was the officer appointed by the Board of Trade to make an official inspection of the Central London Railway prior to its being opened for traffic, and this inspection extended over six days. He had also inspected the City and Waterloo and the Central London Railway. It seemed to him that the essence of a train service on a tube railway should be in the direction of rapidity and regularity of the service, and therefore he considered that it was of very great importance that the arrangements for working should be of the simplest possible character. The risks in these underground railways might be of a very appalling character—risks which were not in existence upon ordinary open-air railways. The particular risks to which he referred at the present moment were those connected with the confined space in which the railway was carried, and therefore the impossibility, in case of collision, of the cars being moved laterally out of the way of the colliding train. In case of collision, the whole of the cars would be liable to be wedged against the side of the tubes, with very disastrous results. There was also danger from the presence of a highly charged electrical conductor, which, apart from any possible injury which might be caused to passengers, might also be liable to cause fire, and what was even worse, to generate smoke. A very small fire, which, in the open would be of no importance, might, in a tube, create a volume of smoke, and be of a most dangerous character.

The CHAIRMAN: Therefore it is your opinion that special precautions should be taken in the regulations for the working of tube railways?

I certainly think so, and I might go even further, and would urge that confluent junctions should, as far as possible, be avoided. Continuing, the Witness said that as soon as the railway came out into the open, he did not see the same objection to the junctions. He had heard the evidence of Sir Alexander Binnie, and he agreed with him that a confluent junction was incompatible with a rapid train service. Then, again, the signalling in tube railways was a very difficult matter, as the signals could only be placed in a very confined space of the same height, and consequently a very small amount of curvature or a change of the gradients in the line prevented the driver having a view of the signals until he was close upon them. His opinion was that it was better to avoid bifurcation—separate and distinct systems were preferable with interchange stations. If necessary he would impose the construction of interchange stations upon the companies. As to loops in his judgment it was not necessary in all cases to make provision for such loops, but in a large number of cases they might be desirable. On lines worked by the multiple unit system, the need for loops would be very much modified. However perfect crossings and points might be in their details, there were always spots on railways where derailment was more likely to occur than at others, and the only place where derailment had occurred on the Central London was on the points where the trains were shunted from one line to another. Loops in which passenger trains were to run should not be of a less radius than 5 chains—the curve must not be too sharp. He did not see any possible objection to lines being constructed in tubes where necessary, and emerging into the open air, and he should say that the sooner they came into the open air the better, as in the open the lines could be worked safer and cheaper. He was in favour of the direct route system rather than the close circuit system. He saw no objection to an end-on junction, but to make one or more routes with an end-on junction so as to form through routes was, in his opinion, a doubtful expediency. He did not consider it would be feasible to run an all-night service of tube railways, because an interval of a few hours must always be left for examining the lines and for doing any necessary repairs.

The Committee then adjourned.

On Tuesday counsel for the various Bills addressed the Committee. Mr. MOON in the course of his speech referred to the question of a uniform fare, which, he said, if insisted upon by the Committee, would be fatal to the construction of some of the lines. He reminded their Lordships that the City and South London Company had tried a uniform fare, but had been obliged to discontinue it. It was perfectly true that the uniform fare suited the requirements of the Central London Railway, but that was the only tubular railway which such a system would serve, and that because there was no competition with it except by omnibuses. The advantage in time, even for short distances, was so great that a passenger would prefer to pay 2d. rather than 1d. by omnibus; but that condition of things would not apply to other tube railways. In the case of the City and South London Railway, 50 per cent. of the passengers were carried for less than 2d., and, therefore, the Committee would see that the adoption of a uniform fare would be a very serious matter. Whether a uniform fare should be adopted must depend upon the particular circumstances of each railway.

Lord KNUTSFORD said the Committee were of opinion that it would not do to impose it as a condition upon any railway that there should be a uniform fare.

At the conclusion of counsels' speeches, the Committee deliberated in private for a considerable time, and upon re-admitting the public the CHAIRMAN said the Committee considered that they had concluded the evidence upon the questions before them, but if counsel for owners, lessees and occupiers thought that, having regard to the present state of the law, they were not sufficiently protected from damage and annoyance, the Committee would be prepared to hear them on the subject at the adjourned meeting on Friday.

The Committee then adjourned.

ELECTRIC LIGHTING IN MARYLEBONE.

THE Electric Lighting Provisional Order Confirmation Bill (No. 1) came before the Examiner of the House of Lords on Tuesday, and standing orders were found to have been complied with. When the Bill was before a Select Committee of the House of Commons, there were two competing orders, viz., that of the Metropolitan Borough Council of St. Marylebone, and that of the Metropolitan Electric Supply Company, Limited. An arrangement was come to between the parties, and the Bill amended, and in its amended form passed the House of Commons. The amended Bill, which will now go for second reading in the House of Lords, provides that the Metropolitan Electric Supply Company shall sell to the Borough Council of St. Marylebone, the undertaking and business of the company within the area, except the offices of the company and the extra high-pressure trunk mains, for such sum as may be agreed upon by the two parties, or failing agreement, as may be fixed by arbitration. The company has the powers to relay, maintain, alter or renew their trunk mains through the borough.

WORCESTER TRAMWAYS.

THE Worcester Tramways Bill was found by the Examiner of the House of Commons to have complied with the Standing Orders on Tuesday. The Act empowers the Worcester Tramways, Limited, to construct new tramways in lieu of their existing tramways, and to work the same by mechanical power. No. 1 tramway is 1 mile 3 furlongs $\frac{3}{10}$ chain; No. 2 is 4 furlongs and $\frac{5}{10}$ chain; No. 3 is 6 furlongs and $\frac{6}{10}$ chain; and No. 4 is 3 furlongs and $\frac{3}{10}$ chain. One clause in the Bill states that the company shall, so long as required by the Corporation, construct and maintain a waiting room for passengers in a situation on the route of the tramways.

SMETHWICK CORPORATION BILL.

ON Thursday the Omnibus Bill of the Smethwick Corporation passed the Examiner in the House of Commons as having complied with standing orders, and will go for second reading. The Bill confers powers upon the Corporation with respect to the tramways, electric light and other undertakings. Tramways have been constructed in the borough in pursuance of powers conferred by the Birmingham and Western District Tramway Order of 1881, and further powers are now asked to authorise the Corporation by agreement to purchase any authorised tramway outside the borough which forms continuations of the authorised tramways within the borough, with the consent of the local authorities. The Corporation is given power to reconstruct the tramways for electric traction, and to supply electricity for working the same. They shall not, however, interfere with any of the tramways until they have acquired them, except with the consent of the owners. Borrowing powers in respect of tramways are authorised.

ELECTRIC LIGHT PROVISIONAL ORDERS.

A COMMITTEE of the House of Lords, presided over by Lord Pirbright, on 19th inst. considered the Electric Lighting Provisional Orders Bill (No. 7). The Bill dealt with the following Orders:—

Barry, in the County of Glamorgan.—Order to the Barry Urban District Council.

Crompton, in the County of Lancaster.—Order to the Urban District Council.

Foots Cray, in the County of Kent.—The undertakers are the Rural District Council of Bromley; but with respect to a part of the order to supply within the Urban District of Chislehurst, the Council are not the local authority within the meaning of the Act. The provisional order is granted by the Board of Trade in respect of the contributory places of Foots Cray and a portion of the lower borough ward of the urban district of Chislehurst. The Chislehurst Urban District Council is the local authority for that part of the undertaking, and power is given for that Council to acquire that part of the undertaking at the expiration of 10 years from January 1st, 1902, on giving one year's notice of their intention to purchase.

Friern Barnet, in the County of Middlesex.—Order to the Urban District Council.

Isle of Thanet.—Provisional Order granted to the Isle of Thanet Electric Tramways and Lighting Company, Limited, in respect to the parishes of Garlinge, Northdown and St. Peter's, extra part of the Isle of Thanet Rural District in the County of Kent.

Newbury, in the County of Berks.—The undertakers are the Urban Electric Supply Company, Limited.

Pudsey, in the West Riding of York.—Order granted to the Mayor and Corporation of Pudsey.

Ross, in the County of Hereford.—The undertaker is John Parker, engineer, of Hereford, but the powers are not to be authorised unless the undertaker transfers the undertaking to the Ross Electric Light and Power Company or the local authority.

Royton, in the County of Lancaster.—Order granted to the Urban District Council.

The orders referring to the above districts were not opposed, but there was one order with respect to Roundhay, which was opposed.

On Monday the Electric Lighting Provisional Orders, Nos. 6 and 10, which have already passed the House of Lords, came before the Examiner in the House of Commons, and standing orders were found to have been complied with. No. 6 confirmed orders granted by the Board of Trade to the local authorities of Aberavon, Ashton-in-Makerfield, Hampton, Ince-in-Makerfield, Mountain Ash, Neath, Pontypridd, Teddington, and Worsley. No. 10 Bill confers electric lighting powers on the urban districts of Blackrock, Dungannon, Kildare, and the Corporation of Waterford.

TRAMWAY PROVISIONAL ORDERS.

THE Tramways Orders Confirmation (No. 2) Bill came before a Select Committee of the House of Lords, presided over by Lord Harris, on 19th inst. The Bill confirms the provisional orders of the Board of Trade in regard to the construction of tramways to the Swindon Corporation, the Birkdale Urban District Council, the Crompton Urban District Council, the Wrexham District Council, and to the Leamington and Warwick Tramways and Omnibus Company.

In the case of the Leamington and Warwick Tramways Company power is given to alter the gauge of so much of the tramways of the company as are situated within the Borough of Royal Leamington Spa, and for the working of same by mechanical power. Notice of opposition was given, but there was no appearance before the Committee.

With regard to the order to the Birkdale Urban District Council, which authorised the construction of a new tramways within the district, there were petitions against the Bill by the British Electric Traction Company and the Lancashire and Yorkshire Railway Company.

Mr. BALFOUR BROWNE, K.C., who with Mr. Moon appeared for the District Council, said the order authorised the Council to construct two small tramways in the town of Birkdale. Last year the Council and the British Electric Traction Company entered into an agreement by which it was agreed that the Council should, as soon as they were entitled to do so, purchase so much of the tramways therein mentioned as were situate in their district in accordance with the Act, and that the petitioners should reimburse the Council the amount paid for such tramways, and the costs and charges incurred. It was further agreed that the Council should, on such purchase being completed, grant to the petitioners a lease of the said tramways for a term of 21 years, and on the expiration of the lease renew it for a further term of 14 years, subject to the consent of Parliament. The Council now proposed to construct certain new tramways, but the Board of Trade had not power to enable them to grant a lease for 35 years. With the assent of both parties, it was now proposed to bring up a clause authorising the Council to grant to the petitioners a lease or leases of the tramways, or any part thereof, for a period not exceeding 35 years.

Mr. SHAW, on behalf of the British Electric Traction Company, having supported the clause, the Committee agreed to its insertion.

A clause was brought up for the protection of the Lancashire and Yorkshire Railway Company, over whose line the tramways passed, and this was inserted.

With these amendments the Bill was ordered to be reported for third reading.

METROPOLITAN DISTRICT RAILWAY BILL.

THIS Bill came before the Select Committee of the House of Commons, presided over by Sir John Kennaway on Tuesday. Mr. PEMBER, K.C., who, with Mr. Clode, represented the promoters, in opening the Bill, said it was an extremely simple matter, and would not occupy the attention of the Committee. Its object was to perfect the arrangements which had already been come to with the sanction of Parliament to work the lines of the Metropolitan District Railway Company electrically, as far as the inner circle was concerned. The company was first authorised to use electric traction by the Act of 1897, and subsequently they got another Act in 1900 giving them more complete powers under which they were duly authorised to carry out the conversion of the railway from steam to electric traction, and the present Bill was one to empower the company to enter into an agreement to carry out their object. For many years past it had been felt that it would be a vast improvement if both the Metropolitan and Metropolitan District Railways could be worked by electricity. The increase of comfort that there was on such railways as the Central London was particularly emphasised in their minds, because they had suffered a great abstraction of traffic consequent upon the opening of that line. His clients had got power to work the railway by electricity, and also they had obtained the necessary powers to erect a generating station to provide a supply of electrical energy, but financially the position of the company was extremely necessitous. For some years no dividend had been paid on the ordinary stock. The preference dividends were only partially paid, and since the opening of the Central London Railway, the receipts had been reduced by some £800 per week. During the last two years experimental electrical working had been carefully carried out on a small piece of the Metropolitan District Railway, and the system which had been in use there was practically the system which they proposed to adopt under the agreement they wished to get sanctioned by the present Bill. Then came the difficulty of raising the capital for the purpose—which would cost several hundred thousand pounds, and the financial position of the company was such that it would have been practically impossible to raise the money in the ordinary way. Under those circumstances, Mr. Perks, M.P., who was very largely interested in the District Railway, put himself in communication with Mr. Yerkes, of Chicago, a gentleman of great wealth and financial power in the United States. As a result of negotiations an arrangement had been come to with Mr. Yerkes by which the money would be forthcoming. Steps had been taken to form a company, to be called the Metropolitan District Electric Traction Company, Limited, the capital of which would be £1,000,000. The company would be registered in England before the Bill passed the third reading of the House of Commons. Money to the extent of £600,000 had already been subscribed, and Mr. Yerkes had other friends who were going to subscribe another £120,000 or £130,000, which would bring up the total amount already subscribed to £750,000, and Mr. Yerkes was willing to be bound to find the remainder of the capital. The finance of the matter was, therefore, absolutely unassailable.

Mr. J. S. FORBES, chairman of the District Company, gave evidence bearing out the opening statement of counsel, and in cross-examination by Mr. LITTLER, K.C., for the Metropolitan Railway, he said that the District would be able to require any one who ran trains over their lines to use the same method of traction as they had themselves, as it would not be possible to have two systems on the same railway. He did not think that the Ganz system would suit their purpose, although he was aware that it was proposed to use that system in the case of the Metropolitan Railway.

Sir W. PREECE gave evidence as to the proposed method of traction to be employed, and explained that it was a continuous current system, while the Ganz system was an alternating current system—a system against which, personally, he had no objection to raise.

By the CHAIRMAN: He should say that the system proposed to be adopted by the District Company would most nearly meet the requirements of the Board of Trade in regard to the prevention of electrolysis.

After evidence by Mr. PERKS, M.P., dealing with the financial part of the proposal, Mr. YERKES was examined by Mr. CLODE, and replying to questions, he said that for upwards of 35 years he had been interested in the working of cable and electric tramways in America. He was prepared to carry out the agreement he had entered into with the Metropolitan District Railway Company to transform the line into an electric one. For many years he had had his eye upon that railway, and had thought how desirable it would be to change the system of traction. In America they would never tolerate the existence of such a railway. As to the capital, he had intended to reserve £200,000 for English investors, but his friends in America had already subscribed £897,000, leaving only £103,000. The money was all ready; they meant business, if they were allowed to do what they wanted under the present Bill. They did not expect to make anything out of the reconstruction of the line, but to hand it over to the company at cost. They had not the slightest doubt as to the result, because they intended to give a good and rapid service of trains, and to give people full value for their money. As to the system to be employed, it had no name; it was a conglomeration of all the good things which they had had in work in America for the past 15 years. It was the system, very much improved, similar to what they had thousands of miles of electric railways in America run on. The Ganz system might be a very good one, but from what he knew of it he would not use it for the purposes of this railway. With regard to the placing of contracts for the work, Mr. Yerkes said it was his intention to give English firms all the work they could possibly do provided they could do it as cheaply and as well as American firms. If they could not meet him in that respect then he would go to America, but his preference would always be for English firms if at all possible.

Mr. LITTLER, K.C., opened the case on behalf of the Metropolitan Railway, who opposed the Bill, and called Colonel Mellor, the deputy chairman, who said that the question of working their line by electricity had occupied the attention of the directors for the past two years. He considered the question was of immense importance to both the Metropolitan and the District Railway. The Metropolitan Company, by an agreement arrived at in 1897, had power to run over the District company's lines "in the present manner." In 1898 they obtained power to apply electricity to their railway, and a similar right was reserved to the District Railway. If the present Bill was passed, they would be compelled to work on the same system as the District Railway, and if the Yerkes system was adopted, it would stop them using the Ganz system through the whole of the inner circle. Only one system could be used on the line, and the question was—which was the best? His company were most anxious to come to an amicable arrangement with the District if possible, but they objected to having forced upon them a system which had not been investigated.

The Committee then adjourned.

LEGAL.

LIVERPOOL MORTGAGE INSURANCE COMPANY *v.* THE BRITISH ELECTRIC WORKS COMPANY, LIMITED.

IN the Chancery Division of the High Court of Justice on June 22nd, this Liverpool District Registry action came before Mr. Justice Cozens-Hardy as a short cause on motion for judgment.

Mr. EVE, K.C., on behalf of the plaintiffs, said the action was brought by the trustee of a debenture trust deed suing on behalf of himself and all other debenture holders in the defendant company, which was a large concern having works in Birmingham. The debentures had become enforceable by reason of the company having

passed a resolution for the voluntary winding-up of the company. Another reason for the principal moneys becoming due was that the defendant company had failed to keep up the value of its cash in hand, book debts, and stock-in-trade to £30,000, and the trustees had certified that there had been default in that respect. It transpired that the company could not go on unless further money was found. Shortly after the action was commenced Mr. Justice Farwell appointed a receiver and manager of the company, and no defence to the action had been put in.

Mr. Justice Cozens-Hardy expressed surprise that the company did not appear to the action.

Mr. Eve said the proceedings against the company were perfectly regular.

Mr. Justice Cozens-Hardy thought the plaintiffs were entitled to the order they asked for, and he made the common form decree in a debenture-holder's action.

Mr. Eve then proceeded to open a summons asking the Court to sanction a conditional contract which had been entered into for the sale of the company's property to Vickers, Maxim & Co., Limited. The learned counsel said that the price to be paid under the contract was £60,000, and the purchasers undertook certain liabilities to the extent of £6,000, and they acquired among other things the book debts and the cash of the company. The summons also asked for payment of a commission of 2 per cent. to the late managing director of the company who had negotiated the sale.

Mr. Justice Cozens-Hardy thought that that commission seemed extortionate.

Mr. Eve said he had to bring the matter before the Court, but the feeling of all parties was that that gentleman was the only man who had sufficient knowledge of the company's business and the quarters in which it could be disposed of. The terms were that if the managing director found a purchaser he was to have 2 per cent. commission. If the contract was sanctioned the price realised would be sufficient to pay off the whole of the creditors of the company and leave a balance for the shareholders.

Mr. Justice Cozens-Hardy said that made it all the more extraordinary that the company was not represented by counsel.

One of the liquidators of the company rose and made a statement to the effect that at the meeting for which the resolution was passed for voluntary winding-up, two liquidators were appointed and they, although perfectly friendly, were unable to agree upon solicitors who should act for them. A meeting of shareholders had been called in Liverpool for Wednesday next, and if the summons stood over, no doubt counsel would be instructed.

Mr. Eve was anxious that the summons should be specially heard, because in order that the works should be kept going it was necessary to tender for large Government orders. The purchase would be completed one month after the sanction of the Court to the contract, or at the latest by July 31st.

Mr. Justice Cozens-Hardy then adjourned the summons until Friday, and made an order continuing the receiver and manager until August 10th.

Uppingham Gas Company.

In the Chancery Division of the High Court of Justice on June 22nd, Mr. Justice Byrne in this case had before him a petition by the company asking the Court to confirm special resolutions which had been passed for the substitution of a memorandum and articles of association for the deed of settlement under which the company was constituted. Counsel explained that the constitution of the company under the deed of settlement was unduly cumbersome, that amongst other things the proposed alteration would enable the company to carry on the business of an electric lighting company, that creditors were not affected, and that voting power was unaltered.

Mr. Justice Byrne sanctioned the petition with certain modifications.

Berrenberg v. The Berrenberg Electric Lamp Syndicate.

Mr. Justice Darling, in the King's Bench Division, on 20th inst., heard this case, in which Adolf Berrenberg, patentee and vendor of the Berrenberg electric lamp, claimed two months' salary, amounting to £82 16s., and damages for wrongful dismissal to the extent of £167 4s., representing four months' salary. The defendants admitted their liability to pay £74 salary, but justified their dismissal of the plaintiff, who, they alleged, absented himself from their place of business on a holiday without permission, and that he refused to adjust an electric pump which he alone was competent to keep in order. The defendants counterclaimed for £112 on a promissory note, and this the plaintiff admitted.

In the result, his Lordship found for the defendants for £37 with costs.

Howell's Simplex Anti-Inductive Telephone Syndicate, Limited.

The matter of Howell's Simplex Anti-Inductive Telephone Syndicate, Limited, came before Mr. Justice Wright in the Companies' Winding-Up Court on Tuesday, on a summons by the liquidator dealing with the claim of Mr. T. J. Howell. The liquidator asked for directions as to dealing with the claim, which was for cash and shares in connection with the sale of his patents to the syndicate.

Mr. J. Black, who appeared for Mr. Howell, said the latter was an electrical engineer, and in 1898 he invented some valuable improvements in telephones. Not having sufficient capital to exploit them himself he was introduced to a Mr. James Gordon McIntosh, and he agreed to receive £600 in cash and one-third of the shares in a syndicate which McIntosh was about to form. McIntosh then entered into a fresh agreement on his own account, whereby he was to sell to the syndicate the patents he had obtained from Mr. Howell for £2,500 in cash and 5,450 ordinary shares. That agreement was adopted by the syndicate, which he (Mr. Black) submitted also adopted the agreement between Mr. Howell and Mr. McIntosh. They got Mr. Howell's patent rights for Great Britain and abroad, and the capital of the syndicate was £12,000. The syndicate was now being voluntarily wound up, and Mr. Howell having failed to obtain the price agreed upon from McIntosh, now sought to prove in the liquidation. He was, however, in the unfortunate position that his solicitor had absconded with his most valuable documents. He mentioned that his client was totally blind, but that notwithstanding that infliction, he had made most valuable electrical inventions, which were being sought after by the G.P.O. and the principal railway companies; but he was in the position that he could not deal with them, as the syndicate had his patents, for which they had not paid.

Mr. Howell also addressed his Lordship, and said that he had been totally ruined by the action of McIntosh, the syndicate, and others, and had been so destitute as to be without shelter. He claimed £1,230 damages for breach of agreement and the return of his patents. All he had received was £270.

Mr. Russell, for the liquidator, said that if Mr. Howell would return the £270 he had received, he could have his patents.

Mr. Howell said he was quite destitute.

His Lordship said it appeared to him that Mr. Howell had been very badly used by Mr. McIntosh, but in the documents before him there was no evidence of any contract between him and the syndicate. He thought, however, that he might be found to have some title to the patents held by the syndicate on the ground of fraud and conspiracy if he could find money to fight the case.

Mr. Russell said the liquidator was investigating the proceedings of the directors and if necessary he would take proceedings.

His Lordship adjourned the hearing of the summons until July 9th.

Coventry Gas Fitting, Electrical and Engineering Co., Limited.

In the Chancery Division of the High Court of Justice, on Thursday, before Mr. Justice Wright, the petition of the Coventry Gas Fitting, Electrical and Engineering Company and its liquidator for sanction to a scheme of arrangement under the Joint Stock Companies' Act, 1870, was presented.

Mr. Younger, K.C., said the scheme was to transfer the assets of the company to a new company which had been formed to acquire them. The debenture holders consented.

His Lordship, having perused the documents, gave his sanction to the scheme.

CORRESPONDENCE.

Street Lighting.

The article under the above heading in your last issue, by "A Municipal Engineer," whilst a plain and straightforward statement of his own opinion on the subject should, I believe, be simply treated as such only, and not regarded as worth anything more, no matter how well known a name may be hidden under the *nom de plume*, more particularly when he says, "Street lighting by enclosed arc lamps, whether alternating or continuous, is not to be recommended."

Whilst, of course, an advocate of the "Stewart" lamp in particular, I am, I trust, sufficiently broad-minded to be received by my many friends as an advocate of the enclosed lamp in general, and I say without fear of contradiction that, if properly installed, this type of lamp can and does compete most favourably with the "open" arc. I know little of the experience of other electrical men as to the breakage of "inner globes," but I can and do say that I do not sell more than one "inner bulb" per annum for each lamp in use, and have not done so since I adopted the "fire proof" glass some two years since. Even before that date, the breakage of inner bulbs was, I believe, smaller than on any other make of enclosed arc lamps on the market, due, in my opinion, to the shape which was adopted by us, which has been largely copied by other manufacturers, and to which shape (together with careful selection of carbons) I ascribe also the freedom from obscuring deposit, the little which occurs being confined to that portion of the bulb which is above the arc, where it can do little or no harm. "Eternal vigilance is the price of success," and continual trial and experiment is always going on in search of improvements in the shape and material of the bulb and the quality and manufacture of the carbons, with the result that

each improvement issued from '57, New Compton Street, has been an improvement in very deed, and I doubt not other manufacturers could say the same of their own lamps.

That numbers of practical men are not of "A Municipal Engineer's" opinion as to the universal inferiority of enclosed to open arc lamps is shown by their continual specification by some of our best known consulting engineers, and by the fact that throughout the United States they have so largely superseded the open type that at the present moment it is doubtful if there is a single manufactory there for the latter lamp.

British conservativeness has delayed, and will continue to delay, the adoption of the enclosed lamp in this country, but that it will do no more than *delay*, I feel perfectly certain.

It is, of course, somewhat humiliating to know that America has adopted the electrical discoveries of Great Britain, and gone one better on them, but it is, nevertheless, an undoubted fact that our Yankee cousins have been quicker than we have to grasp the conditions necessary to make the enclosed arc lamp a success. For one thing, the angle of greatest light emission is different, and the American electrical engineer has, therefore, altered the height of suspension of his lamps, whilst the Britisher has not, and, in one case, at least, actually increased the height of the columns by some feet, with, needless to say, unsatisfactory results. Oblivious to the fact that an alabaster globe will absorb anything up to 60 per cent. of the light emitted by the arc, he has in many cases attempted to use alabaster inner bulbs as well as outer globes, with the result that a total absorption approaching 75 per cent. has resulted; and, neglecting the universality of the 12-in. or less outer globe on almost all arc lamps in America, he has adhered, with a pertinacity which has done greater credit to his fixity of purpose than to his power to seize and make use of the experience of others, to the 17-in., 18-in., and even 20-in. globe.

I care little for laboratory photometric tests, and think more of the judgment of the man in the street—the 'busman, cab driver, and policeman—who has to work continually in the electric-lighted streets, and I well remember the consensus of his opinion in favour of the 11-in. globes originally installed on the Thomson-Houston lamps as against the highly scientific, but in his opinion, less efficient lanterns used by the Brush Company in the City of London.

Alternating can never compete with direct current, from the public point of view, either for arc lamps or for any other application of electricity, *vide* the published costs of production of central stations on the two systems, and the fact that so many alternating supplies are being converted to direct; but given intelligent use, the alternating "enclosed" can well compete with the alternating "open" type of lamp.

To sum up, if good inner bulbs of the right shape, containing carbons of the best quality, are burned in the best "enclosed" lamps, properly installed, I have no fear but that they will finally oust the best "open" arc lamp obtainable in Great Britain in the same way that they have done in the United States of America.

Douglas C. Bate.

Internal v. International Competition.

We hear much of pessimistic prophets who discern national decadence in every event of the hour, but very little perspicacity is needed to foresee the gloomy outlook looming ahead for the electrical trade generally. It is a truism that the trade needs protection against itself. Failures are frequent and rumours of insolvency many, and unless some vigorous protective action is taken this pressure will become more acute.

Foreign competition is a serious item to consider, but a subject of greater gravity is the internal one of unfair competition among British traders themselves. The unnecessary whittling down of prices in the mad lust for orders, and the placing of architects, consultants, builders, merchants, ironmongers, and plumbers on best trade terms has reduced the *bonâ fide* electrician to serious straits.

From the pages of the Review we learn of the formation of a National Electric Contractors' Association, which doubtless, will achieve good results, but the true amelioration of the evil must be worked out by the manufacturers. Dynamo, lamp and fittings manufacturers need to be called together in friendly consultation, to arrive at a basis of agreement, as to who are to be regarded as *the trade*, and who, therefore, are entitled to trade terms.

Moreover, we are threatened with a new development which savours unpleasantly of the publicans' "tied-house" principle—several manufacturing firms have established or are establishing branches, under other trade names, as electrical contractors, utilising their own manufactures entirely, this unfair competition being utterly detrimental to the legitimate contractor.

An impartial and independent authority is necessary to take the initiative in summoning a representative conference, and if the editors would undertake such a responsibility they would be conferring a benefit on the trade at large.

C. J. Hogan.

June 24th, 1901.

Motor Car Run.

With reference to the electric motor car run of 94¾ miles, reported in your issue of June 21st, and which probably constitutes the world's record, it seems to me that the main point of interest is the battery that made this run possible.

I have every reason to believe that it was one of my own batteries—the "Leitner" battery—now in the hands of the Electrical Undertakings Company, constructed about one year ago, that was used, and which I invented and perfected as long ago as 1895, and on which I worked up to 1900.

It may be remembered that it was also a "Leitner" battery that made the first run to Brighton on one charge on July 4th, 1899, covering 53 miles of very hilly country in a little over five hours. The battery had been used under test conditions for 350 miles previously, and arrived in Brighton with 80 volt c.c. on 40 cells.

Henry Leitner,
Managing Director,
Accumulator Industries, Limited.

Woking, *June 21st*, 1901.

Since writing on the 21st, I have ascertained that the battery used for the long-distance run of the electric vehicle referred to, was actually the old "Leitner" CU6 type, and that the run of 94¾ miles is only one of a series of long-distance runs made with that battery. It seems curious that in all reports of this very creditable run reticence should have been observed about the battery. I believe that the best performance of the battery brought out by the British and Foreign Electrical Vehicle Company, viz., the "Lee-Coll," running the same vehicle, was a little over 60 miles.

Henry Leitner.

Universal Shunts.

When testing with the d'Arsonval or Sullivan galvanometer and universal shunt, I find it is advantageous to introduce a high resistance (about 100,000 ohms) between battery and travelling plug. As the battery must be joined directly to the cable in order to check the instrument zero during the test, the galvanometer coil is short circuited when the lowest multiplying power is being used, and its movement is very sluggish owing to the excessive damping. The introduction of the high resistance causes the coil to be always shunted by, approximately, the total resistance in the universal shunt, thus keeping the damping current constant. By substituting an earth connection for the cable, this high resistance may be used for determining the constant of the galvanometer.

Harold Ohlson.

London, *June 19th*, 1901.

Information Wanted.

We understand that there are firms in the United States who are manufacturers of sheets for electrical purposes, and, we believe, in mild steel, which are being sent to this country. Will you kindly ascertain for us the names and addresses of the American manufacturers of these electrical sheets, as we are

Prospective Buyers.

BUSINESS NOTES.

Electrical Wares Exported.

WEEK ENDING JUNE 26TH, 1900.		WEEK ENDING JUNE 25TH, 1901.	
Aden	Value £46	Adelaide	Value £220
Alexandria	92	Alexandria	7
Algoa Bay	102	Amsterdam	144
Amsterdam	65	Beira	74
Antwerp	22	Bombay	186
„ Elec. fuses	711	„ Teleg. mat.	196
Archangel	105	Calcutta	1,336
Azores	129	Cape Town	1,368
Bombay	50	„ Teleg. mat.	48
Brisbane	105	Chinde	10
Buenos Ayres	66	Christiania. Teleg. wire	20
Cadiz	28	Colombo	98
Calcutta	351	Durban	466
„ Teleg. wire	584	„ Teleg. apparatus	133
Cape Town	222	Fremantle	591
Colombo	330	Gibraltar	12
Durban	50	Halifax	71
Fremantle	40	Malta	86
Hamburg	20	Mauritius. Teleg. mat.	41
Hong Kong	540	Melbourne	168
Labuan. Teleg. mat.	615	„ Teleg. cable	1,023
Mauritius	57	North Atlantic. Teleg. cable	1,000
Melbourne	83	Ostend	50
„ Teleg. mat.	69	Penang	72
Nagasaki. Teleg. cable	12,000	„ Teleg. mat.	26
Paris	100	Perth	105
Penang. Teleg. mat.	37	Port Elizabeth	18
Port Said	40	Port Said	42
St. Petersburg. Teleg. mat.	80	Rio Janeiro	99
Shanghai	238	Shanghai	195
„ Teleg. mat.	129	Singapore	83
Singapore. Teleg. mat.	66	Stockholm. Teleg. wire	177
Sydney	213	Sydney	26
Tokio	41	Valparaiso	75
Townsville	1,186	Yokohama. Teleg. cable	6,534
Trinidad	40		
Yokosuka	578		
Total	£19,320	Total	£14,737

Foreign Goods Transhipped.

Brisbane. Elec. apparatus	Value £355
Melbourne. Elec. goods	93
Sydney. Telephones	368
Total	£816
New York. Elec. motors.	Value £169

Annual Outing.—The staff of the Electricity and Public Lighting Department of the St. Pancras Borough Council went for its seventh annual outing to Clacton-on-Sea on Saturday, June 15th. A party of about 70 spent a very enjoyable day.

Bankruptcy Proceedings.—Henry George Massingham, electrical engineer, and managing director of the West of England Boot Supply Company, who had been in business in Exeter and Torquay, came up for examination at Exeter Bankruptcy Court on 20th inst. Gross liabilities, £7,827 8s. 10d.; expected to rank, £2,689 13s. 4d.; estimated deficiency, £2,378 1s. 11d. Causes of failure alleged were losses in connection with electric light undertakings, and moneys paid for and liabilities incurred on behalf of the Boot Supply Company. The examination was adjourned until next month.

The public examination of C. A. Church, Hampstead Road, electrical engineer, trading as Hy. Conolly & Co., is arranged for July 24th, at Carey Street, W.C.

A meeting of creditors of G. F. Cook & Sons, of Bradford, was held on 18th inst. The failure was attributed to losses on contracts, and the Official Receiver will wind up the estate.

Liquidations.—The Premier Electric Lamp Syndicate will meet at Liverpool on August 13th, for hearing an account of the winding up from the liquidator, Mr. D. L. Chalmers.

A meeting of the Aluminium Company will be held at 13, Abchurch Lane, E.C., on July 26th, to hear an account of the winding up proceedings from the liquidator, Mr. Percy S. Court.

Book Received.—"Science Abstracts" for June. London: E. & F. N. Spon, Limited. 2s.

Catalogues and Lists.—The Unbreakable Pulley and Millgearing Company, Limited, of Manchester, sends us a circular illustrating its adjustable swivel bearings, showing their employment in several works.

A list of the Pflüger accumulator comes to hand from Dr. Pflüger and Co., of Berlin. The batteries are in service for mechanically working organs, pianos, &c., also for medical and dental apparatus, portable lamps, wireless telegraphy, and other purposes.

Messrs. J. E. H. Andrew & Co., Limited, have forwarded to us a set of their latest catalogues and lists of the "Stockport" gas engines, which are made in sizes of from 1 to 250 effective H.P. They have recently added important improvements, and are making a speciality of large power gas engines to work all kinds of gas. A note of some of the orders received is given in the catalogue. Another list, beautifully illustrated, describes the "Stockport" gas engines exhibited at Glasgow. A pamphlet contains copy of a report by Messrs. Handcock & Dykes on a test of these engines, which are driving dynamos at Messrs. Harmsworth's printing works at Gravesend. The plant there consists of three "T" size engines of 80 B.H.P., each driving, by Tullis's link belting, a Mavor & Coulson Sayers-wound dynamo. Two Dowson gas producers are also employed in connection with this installation.

A list of Averly's electric self-lifting pulley blocks, electric travelling pulley blocks and auto-conveyors comes to hand from Mr. T. Veasey, of 5, Copthall Buildings, E.C., who is the sole representative for the U.K. of Mr. George Averly, of Lyons. The blocks are recommended for electric power station service.

The International Electric Company send us a circular of their "servant's morning call." The annunciator is fixed in the mistress's room, and the closed circuit push in the servant's room. By pulling up the flap, contact is made inside the small box, and the bell continues ringing until the circuit is interrupted by the party at the other end pressing the closed circuit push.

Lists of Ciceri Smith's patent rapid-reading micrometers have come to hand from Mr. J. Ciceri Smith, of Hatton Garden, &c.

The B.T.H. Company has issued three new lists as follows:—No. 98, Lever station switches; No. 99, Magnetic blow-out automatic circuit breakers; No. 100, Direct-current fan motors.

The G.E.C. leaflet for June shows Robertson lamps, balancing coils for arc lighting, the "Queen" automatic torch for wiremen, and several other specialities.

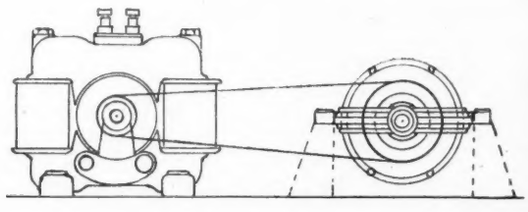
A price card of Conradty arc carbons has been issued by the Sloan Electrical Company, Limited.

Changes in the B.T.H. Company.—In view of certain statements that have appeared in the daily Press, and in answer to numerous inquiries in regard to the same, the British Thomson-Houston Company inform us that the facts as reported are substantially correct. As is well known, the British Thomson-Houston Company own the patent rights for Great Britain of the General Electric Company of New York, the Thomson-Houston and other companies, and, whilst the General Electric Company of New York have always been interested to a certain extent in the British Thomson-Houston Company, they have now increased that interest, and purchased B.T.H. stock, formerly held on the Continent. This does not affect the holdings in this country, and, in fact, the purchase meets with the approval of the British shareholders. The works, now being built at Rugby, will be pushed to completion so that the manufacture of apparatus for the English market and export will be commenced as soon as possible. The board of the British Thomson-Houston Company will be joined by Mr. C. A. Coffin, president, and General Eugene Griffin, first vice-president of the General Electric Company of New York, thus giving the General Electric Company of New York three directors out of a total of 13, Mr. W. J. Clark, the manager of the foreign department of the General Electric Company, already being a member.

Corliss Engines for Electric Traction.—From Messrs. Cole, Marchent & Morley, Limited, of Bradford, we have received a very pleasing and effective wall-card with a photo block of one of two vertical engines which they have recently installed for the Sheffield Corporation, and which are now working at their tramway generating station at Kelham Island. The firm are building to standard designs, horizontal and vertical Corliss engines, in two series of standard sizes, and these are now in successful operation in different parts of the country.

Institution of Junior Engineers.—We have received the volume containing record of the transactions of this growing Institution for the year 1899—1900. It is edited by the enterprising secretary, and published at 47, Fentiman Road, S.W., at 10s. 6d. The present volume is No. 10, and deals with the work of the 19th session, its contents including the following among other papers:—"Arc Lamps and Arc Lighting," by H. G. Cotsworth; "Balancing of Engines," by W. E. Dalby; "A Short Review of the Motor Car Industry," by Basil H. Joy; the Hon. C. A. Parsons's presidential address; "Wireless Telegraphy," by R. P. Howgrave-Graham. Visits to works of electrical and engineering interest both in London and the provinces are recorded, and details of the different installations are included. The secretary, Mr. Walter T. Dunn, desires us to announce that the address of the Institution on and after July 1st will be 39, Victoria Street, Westminster, rooms having been taken there on the first floor for offices, reading-room, library, &c.

The Joel Motor.—On Friday last at the works of Messrs. Henry F. Joel & Co., at Wilson Street, some tests were made of their new electric carriage motor. Our illustration shows a 2-H.P. Joel electric motor, weighing only 112 lbs., specially designed



for propelling road carriages, driving a 2-KW. (type 3) dynamo, weighing over 5 cwt. The speed, load and direction of the motor was varied, and the motor was, we understand, shown to run with fixed brushes, without the slightest sign of a spark or heating. The motor was run with 60 amperes and 32 volts at 500 revolutions per minute, and drove the dynamo at 1,100 revolutions to give 60 volts 20 amperes, or with the loss in dynamo over 2 B.H.P. at the motor. The motor runs free with 8 amperes and 32 volts; this shows an efficiency of 90 per cent. Any progress in electromobiles is gratifying. Much depends upon the reduction of weight, and increase of efficiency in the motor, at such a slow speed, taken with reduced weight and increased output in the batteries. It is thought

that this motor is probably the lightest weight, taking power and speed into account, yet made. The motor is an 8-pole shunt wound with internal fields, and an external armature. The axle is revolved in end bearings, and the whole is enclosed in a water and dust tight case. A comparison of the sizes of the motor with the dynamo can be made from the illustration. We are informed that one of the experiments was unique; with 30 amperes through the armature, which was revolving, the fields were cut off, and there was no sparking. It was also overloaded to 90 amperes, and the fields weakened to one-half without any stress or sparking, and these tests proved the motor to be specially suitable for the rough and varied use required of it, in a motor car. Messrs. Joel & Co. also showed their electric voiturette ("The Brighton car"), upon which these motors are used, and the Rosenthal batteries for driving the car.

The Kensington and Notting Hill Works.—In our first instalment of the description of the Kensington and Notting Hill Company's joint works in last week's issue, we omitted to say that although the alternators are supplied by the Maschinenfabrik Oerliken, the General Electric Company (1900), Limited, were the contractors.

Private Bills.—The Yorkshire Electric Power Bill passed its third reading in the Commons on June 20th.

Summer Holidays.—No. 2 of a series of local guides, issued by authority of the L. and S.-W. Railway, gives some particulars of the Bude, Clovelly, Boscastel, Tintagel and district, which may be of use to some whose thoughts are now bent on summer holidays' arrangements. A few of the chief features of this very attractive part of the country are illustrated.

Trade Announcements.—The Improved Electric Glow Lamp Company, Limited, is removing on July 1st from 103, Queen Victoria Street, to 7, Great Newport Street, St. Martin's Lane, W.C. This removal is due to the company's inability to renew the lease (now terminating) of the old premises, and to the large increase of business in street lighting and other departments which will make the concentration of offices and works upon larger premises an advantage. In future the company will confine itself exclusively to the trade. It will continue to make a speciality of electric lamps as heretofore, and of street lighting and all fittings and work in connection therewith, but in addition will have an extensive show and large stocks of motors and other electrical accessories of all descriptions. Several new lists are in course of preparation.

Mr. James Moss has commenced business as an electrical and mechanical engineer and engineers' agent at Tower Chambers, Brown Street, Manchester.

The Fuller-Wenström Electrical Manufacturing Company have opened a factory at Haunch of Venison Yard, Brook Street, W., for the manufacture of their well-known motors, of which a large stock is kept. The company also stock a considerable number of machines complete, ready for winding to any given specification. A certain portion of the factory has been set aside for repair work of every description. The company have just brought out a new price list of their single-phase induction motors, giving electrical and mechanical data *re* same, curves showing starting torque and current, also details of starting devices.

Wages of Engineers.—At Tuesday's L.C.C. meeting the Finance Committee stated that by an agreement between the London and District Association of Engineering Employers and the Amalgamated Society of Engineers the rates of wages of workmen in the engineering trades had been increased 1s. a week, or ¼d. per hour (according to the custom of the firm concerned), as from May 11th last. On the recommendation of the Committee it was decided to increase the Council's rates of wages as follows:—Brass finishers, coppersmiths, turners, fitters and erectors, millwrights and smiths, from 8¾d. to 9¼d. per hour; pattern makers to 9¼d.; and borers, slotters and planers from 8¾d. to 9¼d. per hour.

ELECTRIC LIGHT AND POWER NOTES.

Abercarn.—The Electrical Committee recommended that before proceeding further in the matter of the supply of electricity for the Abercarn urban district the Council should endeavour to ascertain whether the Newbridge and Abercarn Gasworks Company were prepared to enter into negotiations for the sale of their works. The Risca D.C. proposes taking a similar step with regard to the Risca Gas Company, and if these negotiations fall through, probably the two Councils will consider a joint scheme of electric lighting.

Aberdeen.—A Council deputation has been round about the provinces seeing what other towns have done in the way of refuse destructors. Paisley, Darwen, Bradford, Sheffield and Liverpool, also Whitechapel, Fulham, and two other London districts were visited. Sites are being considered for the proposed Aberdeen destructor.

Ardsley.—The U.D.C. is to apply for a provisional order.

Asylum Lighting.—An electric light and power installation has been decided upon for the Stone Asylum, Bucks, at a cost of £4,700.

Barnstaple.—The T.C. is to borrow £27,000 for electric lighting, and has decided on a site for works.

Bath.—Last week the Council confirmed Mr. Teague's appointment as electrical engineer at £350 per annum, and resolved to pay £25 towards his removal expenses from Paisley to Bath.

Bournemouth.—Negotiations with the electric light company for purchase of their undertaking are still proceeding. The Council has informed the company that it cannot materially increase the offer already made.

Brierfield.—The Colne Town Council has objected to its electrical engineer, Mr. A. G. Cooper, supervising the erection of the Brierfield electricity plant.

Bury.—The annual report of Mr. S. J. Watson, engineer and manager of the electricity works, for the year ending March 31st, 1901, states that the number of consumers at end of March was 254, as against 41 at March 31st, 1897, and that the number of 8-C.P. lamps connected with the works was 18,559, as against 2,481 on March 31st, 1897. The number of units sold during the year, at various prices per unit, was 261,247, as against 213,395 during the previous year. The maximum load in KW. was 223·7, and the load factor was 13½ per cent., Mr. Watson observing that the increase in the load factor was satisfactory, as it showed that the maximum load had been used for an average of 3 hours 20 minutes per day, compared with 3 hours only for the previous year; and that this improvement was principally due to the extended use of the supply for power purposes. Considerable additions which have been made to the plant during the period, and the total capacity, after an allowance for spares, is now 14,600 8-C P. lamps alight at once. The application of motors for driving machinery was making steady progress, an impetus having been given to the demand by the decision of the committee to let motors on hire. The number of motors now connected with the works was 29, equal to 98 H.P. The generating cost amounted to £2,607, which was equal to 2·40d. per unit, as against £1,595, equal to 1·79d. per unit for 1900, and £1,089, equal to 2·26d. per unit for 1899. The total revenue during the year under review was £4,257, which was equal to 3·91d. per unit. In the previous year the figures were £3,582 and 4·03d. per unit, and in 1899 £2,160 and 4·47d. The loss this year amounted to £657, as against a profit of £184 in 1900, and a loss of £336 in the year before that. The revenue for the year, Mr. Watson points out, showed an increase of £675, or 19 per cent., but the costs, unfortunately, owing to exceptionally adverse circumstances, had also increased by £1,516, or 44 per cent. The principal items of increase were coal, £244; repairs, £336; rent, rates, and taxes, £145; and bank interest, interest on loans, and sinking fund, £504. The high price of fuel had necessitated an additional expenditure of £175, the average price paid being 12s. 6d. per ton, compared with 9s. 6½d. for the previous year. The quantity of fuel used per unit sold had been reduced 8 per cent, owing to greater economy in the running of the works, with the larger output and better load factor. An expenditure of £5,586 had been made on capital account during the year, and the total outlay was now £46,300. In conclusion, Mr. Watson expresses the opinion that a substantial increase in revenue might be anticipated during the current year, but that there should be but a small increase, if any, in the generating costs.

Cardiff.—It having transpired that the Electric Lighting Committee is spending money on capital account without the necessary loan authority, the Committee has requested the engineer to prepare specifications and estimates for necessary immediate further expenditure, so that covering loans may be applied for.

Carmarthen.—The Council has decided not to adopt the electric lighting scheme without a guarantee of at least 300 consumers.

Central Africa.—The *Edinburgh Evening News* says that the Heriot-Watt College, through Prof. Bailey and Mr. A. S. Chalmers, one of its students, is taking part in a movement to supply electric plant for lighting and power to the Livingstonia Mission. The plant is being prepared partly in this country and partly in Switzerland, and Mr. James Stevenson, Glasgow, and others had supplied £4,000 to carry out the scheme. Mr. Chalmers goes out in a month or two with the plant. There is a fine water power on the high uplands above Florence Bay to generate electricity enough to supply 600 lamps of 6 C.P. each and to give power for motors to drive a brick-making machine, a flour mill, a pneumatic hammer, an iron-turning lathe, wood-working machines, and a printing press. Native labour is very scarce in the district.

Cheltenham.—The T.C. has applied to the L.G.B. *re* a £25,000 electric lighting loan.

Clydebank.—Mr. Barr has reported to the T.C. on the refuse destructor proposal.

Croydon.—The Electricity Committee advised that energy for power purposes be supplied on the maximum demand system at 7d. and 1d.

Deal and Walmer.—The Deal and Walmer D.C.'s propose applying for a joint prov. order, and spending £25,000 upon electricity works.

Dublin.—A motion was made before Mr. Justice Boyd, in King's Bench Division, Four Courts, Dublin, on Wednesday, in the matter of Stewart *v.* The *Irish Independent* Company. The motion was on behalf of Messrs. J. and W. Stewart, contractors, of Belfast, for discovery of documents. The action is being brought for £5,000 damages for libels published in the *Daily Independent* and the *Evening Herald*, articles having appeared in these papers

gravely reflecting upon the way the work on the generating station for the electric lighting of Dublin was being carried out by plaintiffs. Judge Boyd made the order sought.

The Blackrock U.D.C. has asked the Lighting Committee whether the Dublin Corporation would supply electricity for lighting their district. The Committee says that if required it will be able to do so as soon as the Pigeon House plant is ready, that is within a little over 12 months.

Ealing.—The D.C. has postponed the question of free wiring for the present. A business manager is to be appointed. Tests of mechanical stokers using nuts, as against ordinary hand-stoked boilers using hard Welsh, are to be made.

East Middlesex.—The cost of the joint promotion by the Tottenham, Edmonton, Enfield, Southgate and Wood Green District Councils of the East Middlesex Electricity Bill amounted to £1,205 17s. 8d. The Bill had to be dropped because Edmonton and Enfield voted against the scheme. The Councils held a conference at Wood Green this (Friday) evening to consider the new position of affairs. Among the members of the Edmonton Council there is a difference of opinion as to the advisability of doing anything further in the matter for the present.

Eston.—The U.C. will support the Cleveland and South Durham Electric Power Bill in the House of Lords, because it will obtain better terms of supply than would have been the case under previously proposed arrangements.

Falkirk.—The T.C. last week considered a proposal by Messrs. Crompton & Co., Limited, to lease the Town Council's power under their electric lighting order. After discussion, a Committee was appointed to visit a number of towns and to witness the working of combined electric lighting and refuse destructors.

Gloucester.—At Tuesday's meeting the Council considered the financial statement of the first year's operation of the electricity works. The amount of the loans authorised was £52,875, of which £10,000 had been borrowed at 2¾ per cent. and £283 8s. repaid out of revenue; leaving £42,875 sanctioned but not borrowed. The capital expenditure totalled £54,384 4s. 5d. The revenue account for the 8½ months ending March 31st last showed a total expenditure of £1,691 1s. 8d.—(generation of electricity, £1,008 18s. 1d.; repairs and maintenance, £272 11s. 9d.; rates, taxes, &c., £125 5s. 6d.; management expenses, £233 19s. 8d.)—and receipts amounting to £3,050 16s. 7d.—ordinary consumers, £2,275 3s.; street lamps, £681 4s. 7d.; less discounts, £57 4s. 5d.; rental of meters and free wiring rental, £76 12s. 8d.; and hire of buildings and plant for testing machinery, £75. There was thus a balance on revenue account of £1,359 14s. 11d., against which had to be placed interest on £10,000 loan, £203 7s. 1d.; and bank interest, £936 1s. 7d.; leaving a balance to be carried down of £220 6s. 3d. Deducting the last named amount from the one year's repayment of loan £283 8s., there remained a balance to be carried forward to the next account of £63 1s. 9d. The interest on loan and bank interest carried to the date of the opening of the works, amounting to £627 1s. 4d., was carried forward to a suspense account. The quantity of electricity generated in Board of Trade units was 188,334, of which 177,834 were sold—44 public lamps 54,042, and private consumers by meters 123,792; the quantity used on the works being 10,500. Total maximum supply demanded, 223 KW. The resident engineer, Mr. W. J. Bache, made a report for the period from the opening of the works on July 19th, 1900, to the end of March, 1901. In the course of it he pointed out that the excess expenditure over the amount sanctioned was largely accounted for by the extensions which had been made to the public lighting, and additional mains. The revenue expenditure was satisfactory. With regard to the cost of generating, omitting the expenditure on trimming and repairs to the public street lamps, the cost per unit sold was 2·07d., which was a good result for the first year. Since the opening of the works the number of consumers had steadily increased, and if the committee could see their way to make some reduction in the price the increase would be large. Assuming some reduction, it might be reasonably estimated that the output for the current year would be: private lighting, 270,000 units; public lighting, 83,000 units. The cost for generating that number of units would probably be £2,400. To that must be added the sum necessary to provide for interest and repayment charges, which the accountant had stated would amount to £2,400. It would, therefore, be necessary to earn a revenue of at least £4,800 before the undertaking would yield a profit. Assuming that the Committee decided to make a reduction in the price, Mr. Bache felt confident that the total revenue would considerably exceed that sum. The Committee would be fully justified in reducing the initial price in the maximum demand scale from 7d. to 6d. per unit, retaining the second price at 2d. per unit. On that basis they estimated the total revenue would be £5,300, taking the generation costs, interest and repayment charges at £4,800, leaving a net profit on the year's working of £500 to set against the sum of £627 carried to the suspense account.

The Committee recommended that the initial charge be reduced from 7d. to 6d. per unit as from June 30th, and also, on the suggestion of Mr. Bache, that a month's free supply be granted to new consumers who complete their installations and commence to take a supply of electricity before August 31st.

Grays.—Out of 32 applicants, Mr. E. D. Long, of Grays, has been appointed resident electrical engineer by the Urban Council.

Guildford.—The litigation between the Guildford Electricity Supply Company and the Corporation, reported on p. 1050 of the REVIEW last week, has come to an end. The Corporation has come to terms with the company. It has agreed to bear the expense of relaying the company's cable over the whole length of the new bridge, and to pay an agreed sum for the company's costs in the action.

Heckmondwike.—The U.D.C. has appointed Mr. George H. Carter, of St. Helens, resident electrical engineer. The Council's works are now in course of erection and are nearing completion. The laying of the mains will probably be commenced in August.

India.—*Indian Engineering* says that the programme of the Supreme Legislative Council for the season has not yet been settled, "but probably the Bill dealing with the supply of electricity in India will be included in the forthcoming legislation."

Ireland.—Amongst the orders made this week by Mr. Campion, were those authorising the local authorities at Blackrock, Dungarvan, Kildare and Waterford to supply electricity within their several areas. There was no opposition at this stage to any of these, and the Bill confirming provisional orders will shortly be before the House for second reading.

Kendal.—It is hoped to get the electricity works completed by Christmas. Mr. T. N. Rilson who has been appointed resident electrical engineer, and has designed the plans for the installation, is superintending the erection of the works.

Llandudno. — Last week the Electrical Committee reported that the engineer had notified that it was necessary to proceed with the laying of the new feeder cables. Tenders had been received for the work, and a special meeting had been held to consider the tenders, but the committee had not been able to enter very minutely into them. The engineer had also reported that the money expended over and above the amount of the loan received for electrical purposes was £1,624. He estimated the probable amount required during the next two years for the extension of cables, service meters, &c., at £2,000. The committee resolved that the estimate, together with the plan submitted, be approved of, and that application be made to the L.G.B. for sanction to borrow the sums of money mentioned, amounting to £3,624. The committee was empowered to put the work in hand.

London.—STEPNEY.—At a recent meeting of the Borough Council the Finance and Parliamentary Committee presented a report that their attention had been directed to the great delay in proceeding with the extension of the electric lighting undertaking, owing to the fact that the L.C.C. had not yet sanctioned the Council's applications for their consent to borrow the necessary capital. The Committee were informed that the delay in obtaining the London County Council's sanction to the loans applied for was owing to the fact that the Council would not sanction loans for laying of mains unless full particulars of the size, position and length of the mains, and the number of connections, &c., are submitted to them, and this information it is impracticable to supply until after the mains are laid, and this Council's bye-law No. 29 prohibits any work to be paid for out of capital being proceeded with until the consent of the sanctioning authority to the borrowing has been received. The Committee therefore recommended that an additional paragraph should be added to this bye-law so as to enable the Electric Lighting Committee to proceed with the laying of house-service mains and other connections to existing mains without waiting for the consent of the London County Council to the borrowing of the necessary capital. The report and recommendations were adopted.

GREENWICH.—In view of the application of the City of London Company, Limited, for a prov. order to supply energy throughout the borough, the Borough Council has referred to the General Purposes Committee to consider the whole question of electric lighting of the borough.

HACKNEY.—The Council's electricity works are expected to be supplying energy to the new Empire Theatre, in Mare Street, by October 1st. The station buildings are three parts finished, and the plant is now being laid down.

ISLINGTON.—It is proposed to hold an electrical exhibition in October, to push the electricity supply business with the public.

Mandalay.—A scheme for lighting the streets electrically has been placed before the Municipal Committee by Mr. M. F. Kindersley, agent to the Burma Electric Works Syndicate, Limited, 19, Ashley Place, Victoria, London. The Committee resolved that the syndicate be asked to light a certain portion of Mandalay as an experiment in order to judge of the efficiency of the light which the syndicate proposed in their scheme. The company proposed to instal 20 2,000-C.P. arc lamps and 595 16-C.P. incandescent lamps. The cost to the municipality would be Rs. 49,110.

Midsomer Norton.—Mr. A. H. Preece has reported on a joint electric supply scheme for the Midsomer Norton and Radstock District Councils. The scheme provides for 98 public lamps in Midsomer Norton, and 67 in Radstock. Allowance is also made for 2,500 private lamps of 8 C.P. The site proposed is at Old Welton Colliery, midway between the two districts. It is suggested that the mains should be carried overhead, the poles being also used where necessary, as lamp-posts.

Newark.—A L.G.B. inquiry *re* £30,000 electric lighting loan was held on 19th inst. Mr. Vesey Brown gave details of the scheme.

(Continued on page 1115.)

THE KENSINGTON AND THE NOTTING HILL COMPANIES' JOINT ELECTRICITY WORKS.

(*Concluded from page* 1069.)

The engine house measures 126 ft. long × 45 ft. wide and 49 feet high to the ridge of the roof; the side walls are 27 ft. high, and the travelling crane gantry 28 ft. 6 in. high.

The walls are faced with special leadless white glazed bricks, made by the Shaw's Glazed Brick Company, of Whitebirk, Lancashire; a brown dado and black line is formed with the same make of bricks to a height of 6 feet above the floor.

The machinery foundations are of concrete, and the floor is of concrete covered with a wood block flooring (maple). The machinery consists of the following sets, of which we give several illustrations :—

Exciters.—Two Willans-Parker steam dynamos; engine, F F size., triple-expansion and condensing, two cranks, 65 I.H.P.; dynamos 100 volts × 400 amperes (40 KW.) 450 revolutions per minute.

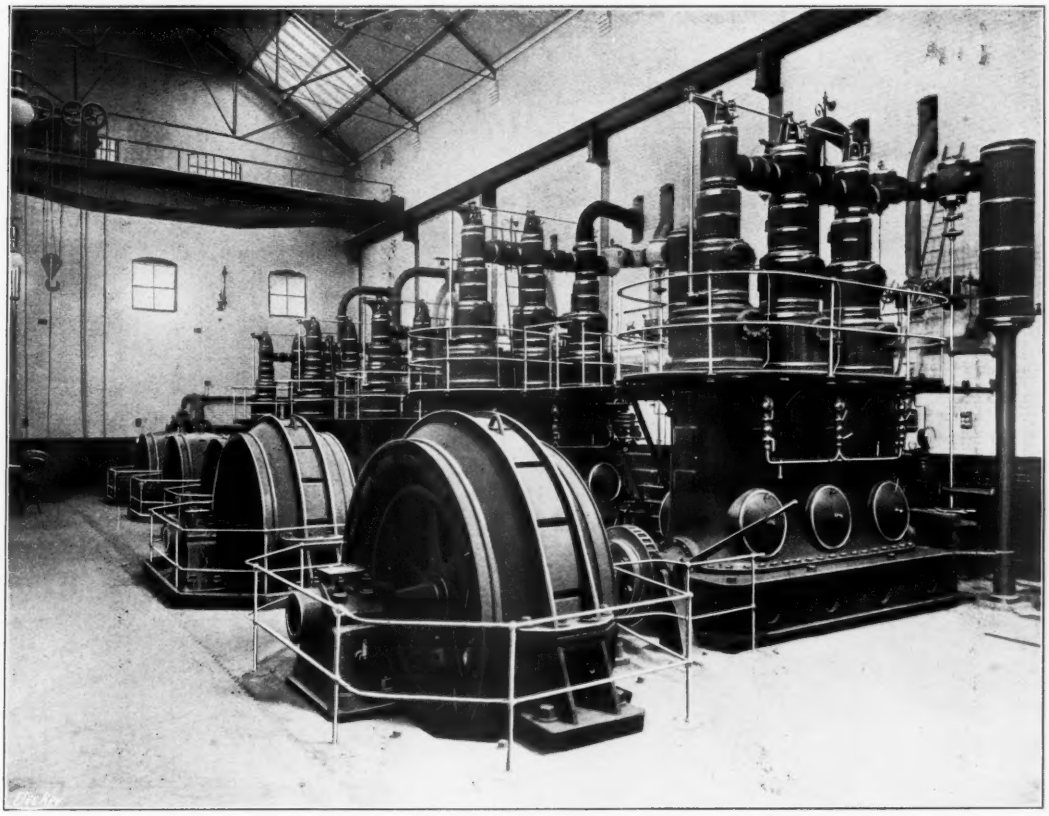
One 60-KW. motor-generator, made by the Maschinenfabrik Oerlikon, Switzerland, consisting of a 5,000-volts three-phase motor, driving a 100-volts × 600 amperes dynamo.

Generators.—There are five generating sets. The three smaller sets consist each of a 575-I.H.P. three-crank, triple-expansion and condensing Willans engine, of the 3 R pattern, coupled to a three-phase Oerlikon 330 KW. inductor alternator. The frequency is 45 cycles per second, at 300 revolutions per minute, and the output 50 amperes in each phase at 5,000 volts.

The two large sets consist each of an 825-I.H.P. three-crank, triple-expansion and condensing Willans engine of the 3 T size, coupled to a three-phase Oerlikon inductor alternator of 550-KW. output (80 amperes per phase and 5,000 volts) at 45 cycles, 270 revolutions per minute.

Each engine is fitted with its own Korting ejector condenser supplied with water from the overhead tank in the boiler house. The discharge is taken to a 20-in. bore cast-iron pipe in a trench at the back of the engines; this pipe passes under the pumps used for the cooling sprays, and then on to the pond. An exhaust pipe to atmosphere is also provided for each engine, the discharge being taken up to the roof.

The engines are lubricated on a new system (patented by Mr. Miller), by which the quantity of oil used is reduced to about one-tenth of that generally required; this is a great consideration where the condensed steam is used again as feed to the boilers. The lubricant is pure powdered graphite mixed with a small quantity of cylinder oil to form a thick paste. The oil is required to prevent the internal parts of the engine from rusting and becoming damaged by the moisture in the steam. This mixture is put into a grease lubricator (made by Messrs. Snowdon & Sons, Millwall) such as is used for forcing grease along pipes to the bearings of engines. The piston of the lubricator is forced down by means of a worm-wheel and worm geared to a ratchet wheel, the ratchet of which is given a reciprocating movement by a speed reducing gear driven by belt from the crankshaft. The speed is set so as to give one drop per minute to the engine, the graphite being fed through small copper pipes. One of these lubricators will last for two months without refilling.



General View of Engine Room.

An electric motor-driven crane, made by Messrs. Marshall

Fleming & Jack, of 20 tons capacity, with a span of 44 ft. and a travel of the whole length of the engine house, has been provided for erecting the plant.

The switchboards were designed by Mr. Miller, and are of novel construction; they were supplied by Messrs. O. Berend & Co., Ltd. They are in five separate sections, and consist of the low pressure board for the exciters, lighting, power and charging accumulators; the panels for the three 330-KW. alternators and the motor-generator; the panels for the trunk mains to the Notting Hill Company's district; the panels for the two 550-KW. alternators; two spare panels for extensions; and the panels for the trunk mains to the Kensington Company's district.

In designing the switchboards for the extra high-pressure current an endeavour has been made to render them safe from accidental contact with any "live" part. On the front of the panels and exposed to view are the instruments and switch-handles. The dials of the instruments are seen through holes cut in the marble panels; the glass covering the dial is the only part that can be touched, and this is surrounded by a metal ring connected to earth.

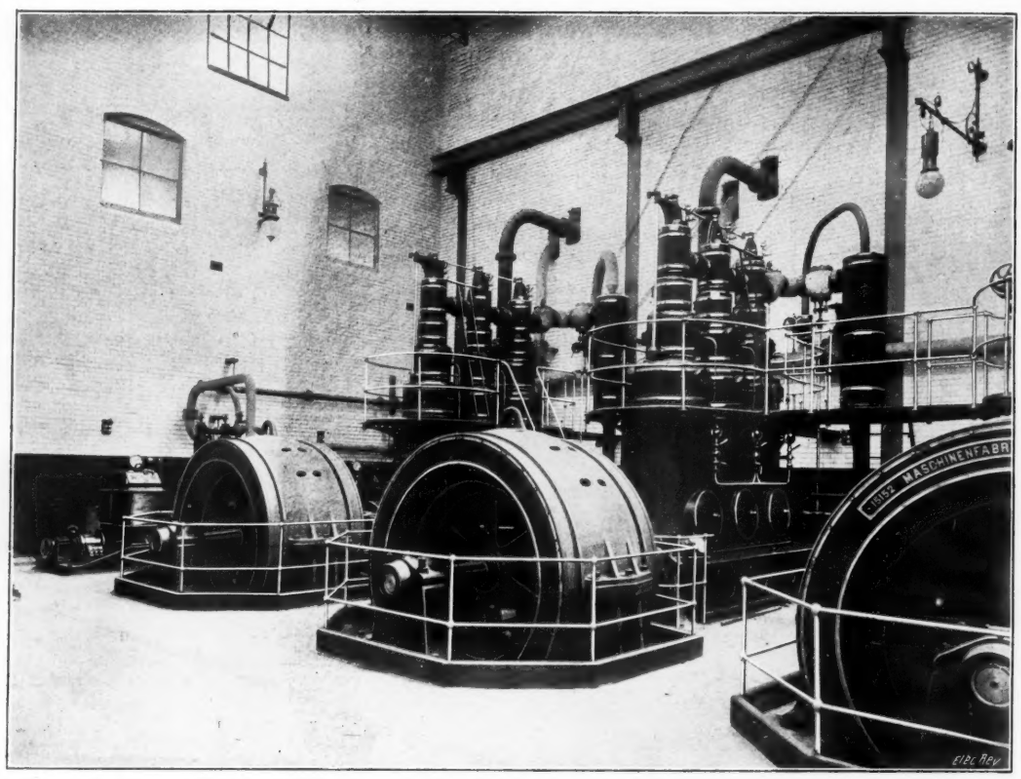
The handle of the 3-pole main switch is also earthed; the other switches and handles for the exciting circuit are low pressure (100 volts). It will be seen that no shock can be received at the front of the boards. At the back of the boards the iron framework is formed into cages, one for each panel, and provided with lock-up iron doors, so that it is possible to go into the space at the back of the boards and look at the apparatus, but not to touch it. The switches and bus bars overhead have similar ironwork guards, to prevent anyone from reaching up to them. In the event of any of the apparatus at the back of the panels requiring adjustment, it is the duty of the engineer-in-charge to cut off the current from the particular panel by means of the main switch, and thus render the parts "dead," and to lock up the main switch before opening the doors of the cage to allow anyone to enter this section. Work can then be carried out although the adjoining panels may be "alive," because these are not accessible, owing to the iron and wire partitions.

The high pressure switches are three-pole, and the parts are so shaped as to constitute horns like those of the well-known lightning arresters at the instant of break. The arc rapidly travels up the horns until the gap becomes too long for it to be maintained, when it quietly breaks. One of the horns is made of a non-arcing metal (zinc) to accelerate this action.

The fuses are provided with similar horns, so as to be available as switches in case of urgent necessity; the fuse wires pass down inside a porcelain tube, and are composed of Britannia metal. These details are shown by the illustrations herewith.

The bus bars form a ring main, with several dividing switches, providing for various separate combinations of generators and mains.

The insulators used for carrying the bus bars, switches, fuses, &c., have all been tested up to 20,000 volts. The cables have been tested up to 10,000 volts for half-an-hour to earth and half-an-hour between each of the cores. These cables are of the "clover leaf" pattern, each of the three cores having a cross-section of 0·15 sq. in.; they are insulated with prepared paper, laid up together, lead-covered and taped. They were made by the British Insulated Wire Company, of Prescot. They are drawn into Doulton's earthenware casings, these casings being surrounded with 6 in. of cement concrete. Under the switchboards they are laid beneath the floor of a cable subway constructed the whole length of the engine house, the subway measuring 6 ft. × 4 ft.; the mains then pass out underground, and are carried under and across the lines of the West London and the Hammersmith and City Railways into Hunt Street, and then away to the two companies' districts. Ten out of 12 cables have been drawn in, each having a capacity of 1,000 KW.; these are laid in duplicate to each transformer sub-station.



VIEW OF HALF OF THE ENGINE ROOM.

At each trunk main panel a three-phase Thomson watt-hour meter, with indicating needle to show the load in kilowatts, is provided for recording the energy supplied to the sub-stations.

The switchboard instruments, both ampere and voltmeters, are mostly of Hartmann & Braun's hot-wire pattern, supplied by Messrs. Johnson & Phillips; there are also Kelvin electrostatic voltmeters, and large dial voltmeters worked through step-down transformers. The latter also supply the synchronising gear (lamps

and voltmeters); the synchronising voltmeters have two needles and two scales, one above the other, one scale showing the bus bar pressure and the other that of the incoming alternator.

The exciter regulating resistance switches have 50 contacts, giving a small variation of the exciting current for each step.

A 30-KW. step-up transformer from 5,000 volts to either 7,500 or 10,000 volts is used for testing the insulation of the alternators or mains.

A set of 56 cells of 600 ampere-hours capacity, made by the Hart Accumulator Company, has been provided for the exciting and lighting circuits.

The workshop which adjoins one side of the engine house is provided with large and small lathes, drilling machine, screwing machine and other tools for carrying out repairs. Railway lines are brought into the workshop, and a 10-ton overhead traveller is provided for unloading goods. This arrangement allows of unpacking goods and getting rid of the dust and dirt before the goods are taken through the large doors into the engine house. In an outbuilding a blacksmith's shop is provided with the usual forge and tools.

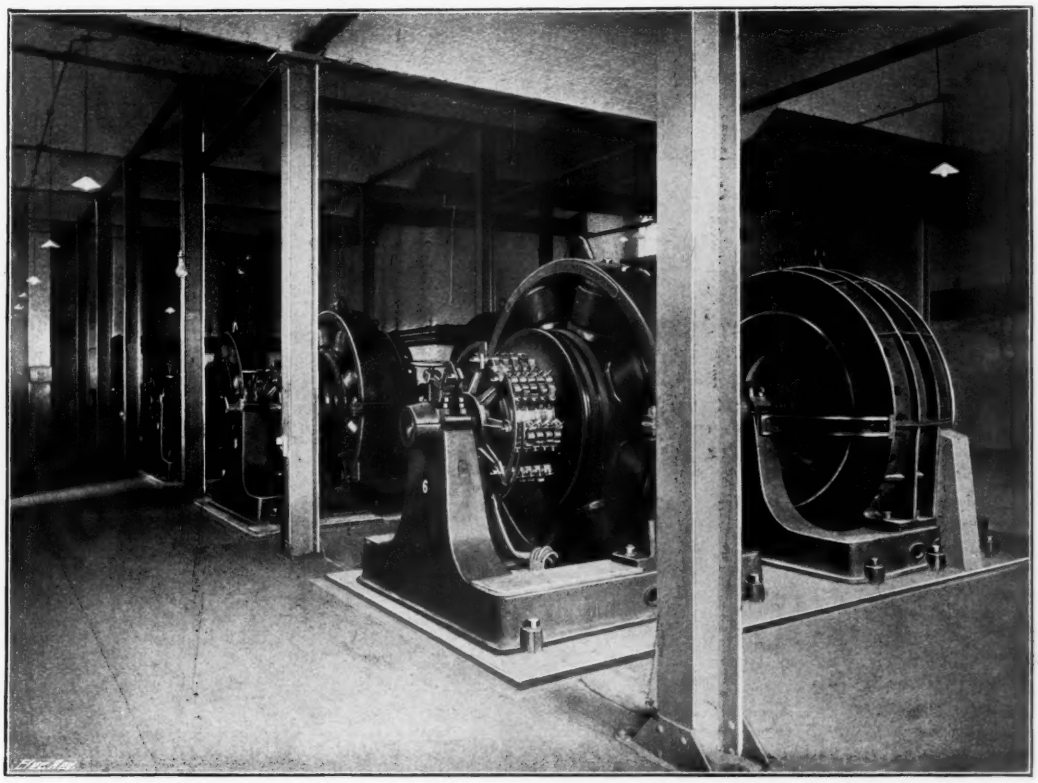
On the first floor are the offices, consisting of clerks', engineers' and drawing offices, board room, stores, lavatories and bath room, as well as the accumulator room.

A complete set of apparatus has been provided for testing coal and for boiler trials. It consists of a 2-in. size high pressure water meter (Schonheyder's), weighbridge for the coal, dasymeter for measuring the CO_2, draught gauge, pyrometer, and Thompson calorimeter.

The various sets of plant were put into use as soon as they were erected and ready to run. Both companies have been receiving power from Wood Lane *viâ* their transformer stations since the end of last year. No hitch or breakdown has occurred, which speaks well for the plant and the care taken with the erecting; it must be remembered that the building operations were still in progress at the time. Such use of the plant would not have been possible with open type engines, on account of the dust, &c., getting into the bearings.

Albert Vaults Transformer Station.

The Kensington and Knightsbridge Company has been peculiarly favoured by fortune in respect of its transformer station. At the back of the Albert Hall, beneath the terrace upon which stands the statue of the Prince Consort, there is a series of roomy vaults, but little below the level of the ground outside, and fairly well lighted by windows; these were rarely, if ever, made use of prior to the advent of the transmission scheme, and they were excessively damp and dirty. Negotiations were opened for a lease of the vaults, and were brought to a successful issue. It was stipulated that the windows should be double, and that they should be permanently closed, to prevent the escape of objectionable sounds, and for the same reason ventilating shafts were prohibited. Some difficulty therefore arose in ensuring adequate ventilation, but this was eventually overcome by means of a large "Sun" electric fan, forcing fresh air under a slight *plenum* into the vaults, whence it escapes by various scattered outlets. In order to dry the vaults hot-water pipes were erected round the walls.



Sub-station, General View (Front).

The site of the station is peculiarly convenient, being practically midway between the two generating stations at Kensington Court and Knightsbridge, and near the centre of the area of supply.

The company entered into possession of the vaults in April, 1900, and in the short space of six months from that time the machinery was put in operation, and has been running ever since. From our illustrations it will be seen that the arched roof is carried upon steel girders and columns, the latter being set rather close together; owing to the restricted head-room, and to the veto against fixing anything whatever to the columns, it was impossible to instal a travelling crane, so that the whole of the equipment had to be got into place and erected by hand, a difficult and tedious operation. As the stator rings of the induction motors were each cast in one piece, and were assembled with their laminated cores before delivery, they were very heavy, and troublesome to handle; the work, however, was successfully carried out by Mr. C. L. Lichtenberg, under the direction of Mr. Miller, and the supply has been maintained without a hitch from the first day of running.

The present equipment of the station, as shown in our illustrations, consists of three motor-generators of 300 KW. each, two of 180 KW., and one of 100 KW. Each of these sets consists of a 5,000-volt three-phase induction motor coupled to an eight-pole dynamo and runs at 380 revolutions per minute, except in the case of the 100-KW. machine, which is six-polar, and runs at 420 revolutions per minute.

SUB-STATION, GENERAL VIEW (BACK).

The induction motors are of the Oerlikon standard pattern, having wound rotors, provided with slip-rings for the insertion of resistance in the secondary at starting. When full speed is attained, the winding is short-circuited by means of a switch, which is brought into play by a forked lever and a sleeve sliding on a feather; the brushes are then removed from the slip rings. These details are clearly seen in our view of the motor-generator which is installed in the generating station. The whole of the high-pressure winding and the terminals are securely cased in, and the frames of the machines are earthed, so that it is impossible for the attendants to receive a shock.

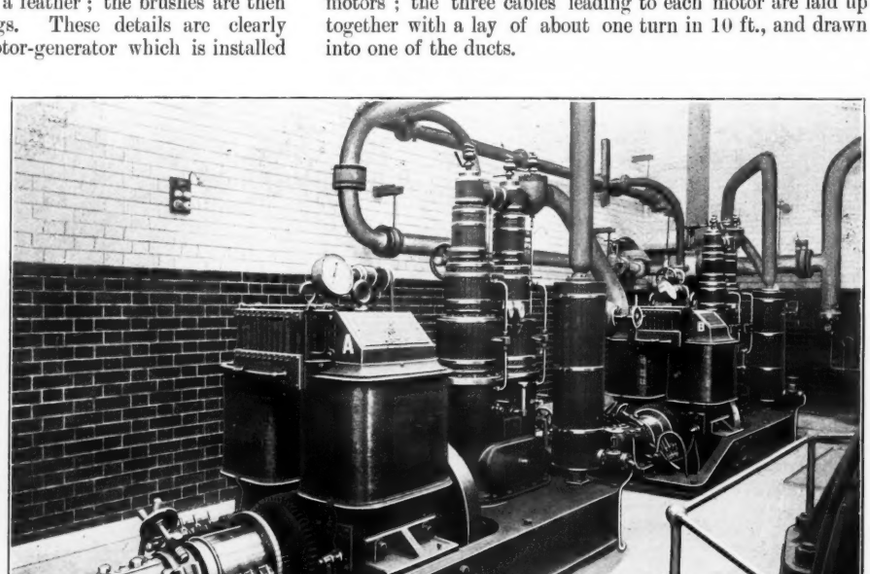
The clearance between the rotor and stator of the motors is only about 1·5 mm.; stout brackets extend from the stator frames to the bearings to ensure rigidity.

The generators have cast-steel yokes, divided horizontally, with separate field magnet cores bolted to them. The bobbins are wound without flanges, and are arranged for separate or shunt excitation. The pole faces are rounded at the corners and slightly chamfered off at the edges. The armatures of the large dynamos are barrel-wound, while in the case of the smaller sets evolute end connections are used. In all cases the brush-gear is carried by the outer bearing, and copper gauze brushes are used, with one carbon brush in each set. All of the direct current generators are wound for 220 volts. One of our views shows one of the 300-KW. motor-generators in position at the transformer station.

There is room for three additional 300-KW. sets in the space at present taken into service; the foundations for these are already put down, as shown in one of our views. After these have been installed, there remains a second vault, equal in size to that now in use, which is in the meantime occupied by the mains department, but will be equipped with transforming plant when the need arises.

The four high-pressure cables from the generating station enter the transformer station just below the roof, as shown in our view of the high-pressure switchboard, and are brought down the wall to B.I.W. joint boxes in which they are divided and coupled to separate cables. The latter are insulated with vulcanised rubber, and were supplied by Messrs. W. T. Henley's Telegraph Works Company, Limited. These cables are carried underground to the high pressure switch gear, which is exactly similar to that at the generating station. Our view of the high pressure board shows clearly the arrangement of the bus bars; these consist of copper tubes, which were adopted in preference to strip for the sake of rigidity, and form three complete rings, divided by disconnecting bars into four portions, each of which can be used independently of the rest. Normally they are coupled up so as to form two sets. As shown, the bars are carried by porcelain insulators fixed to the wall by means of brackets. The whole of the gear on the front of the board is connected with earth, so that it is impossible to receive a shock. Red and blue paper discs cemented to the respective panels serve to indicate to which section of the bus bars any individual main or motor is connected.

From the switchboard, a set of Doulton casings having 12 ducts, is laid under the floor to the various induction motors; the three cables leading to each motor are laid up together with a lay of about one turn in 10 ft., and drawn into one of the ducts.

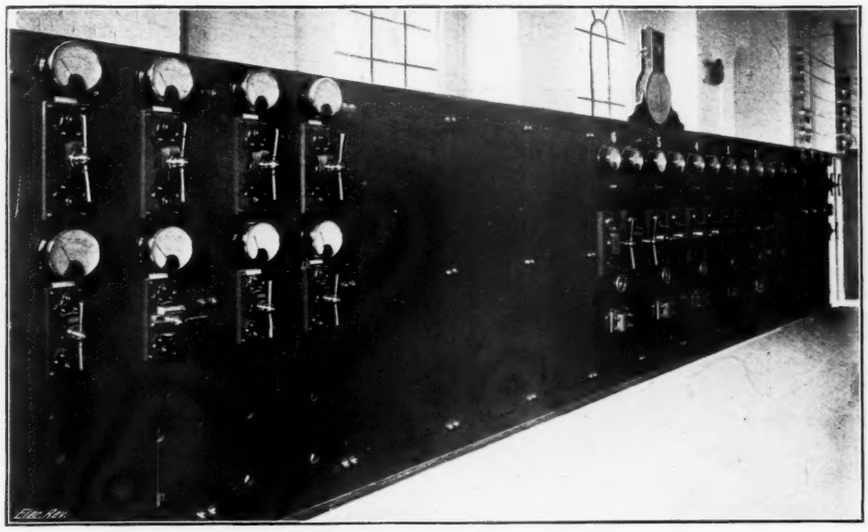


EXCITERS.

The direct current mains from the dynamos are similarly laid underground to the low pressure boards, which were supplied by Messrs. Moy, Limited. These consist of six machine panels (with three spare) and four feeder panels of oiled slate insulated with ebonite washers and carried in iron

frames. Each dynamo panel carries ammeter and voltmeter, two single-pole switches, a single-pole fuse on the positive pole, and a shunt regulator.

The feeder panels, which provide for four 1 sq. in. and three 0·5 sq. in. feeders, are placed at opposite



Sub-station, L.P. Switchboard.

ends of the board, two positive and two negative; each feeder has an ammeter and a switch on each pole. Space is left for four more feeders. The fuses referred to above are provided with a by-pass of resistance wire, enclosed in a fibre tube. This device gives most satisfactory results, the main fuse (of tin) melting without the slightest fuss, and the actual interruption taking place inside the tube quietly, and without damaging the adjoining parts.

The ammeters and voltmeters on the low pressure board are of Messrs. Evershed & Vignoles' moving-coil type, while those on the high pressure board are of Messrs. Johnson and Phillips's hot-wire pattern. There is a Kelvin station voltmeter on each board, that on the high pressure board being controlled by a voltmeter switch for the four trunk mains without the intervention of a transformer.

All the regulation is effected on the low pressure D.C. side by means of the shunt rheostats, which were supplied by the Maschinen Fabrik Oerlikon with the motor-generators.

The whole of the work of erecting the switchboards and the making and erection of the bus bars were carried out by the Kensington Company's staff, under Mr. Lichtenberg. The low pressure bus bars consist of copper strip on edge; part of the positive bar is used as the shunt for a watt-hour meter to record the output of energy.

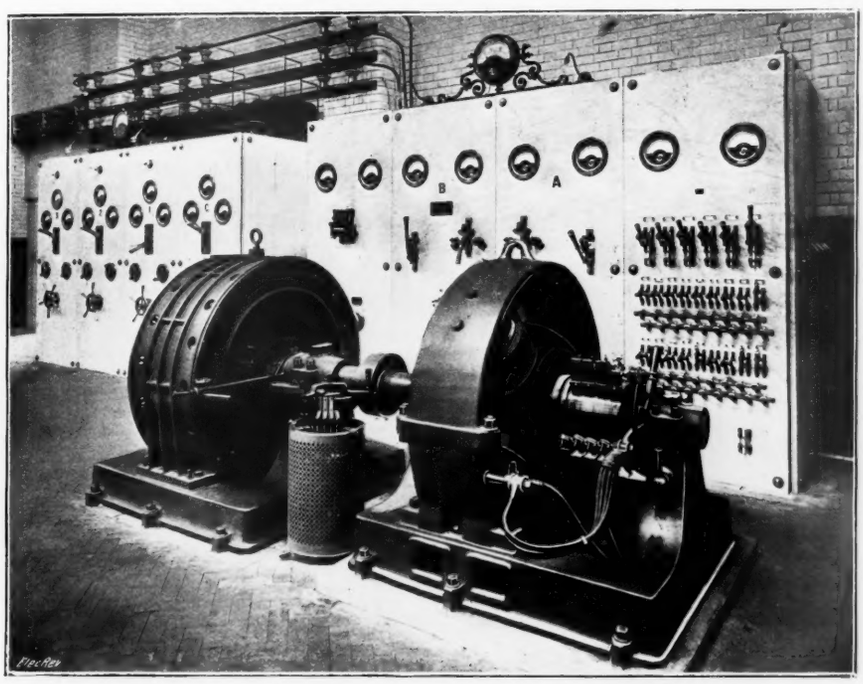
The whole of the present day load of the Kensington and Knightsbridge Company is carried by this transformer station. Supply is at present practically carried on by the two-wire system, for 80 per cent. of the consumers have been changed over to the outers of the three-wire system, and are being supplied at 200 volts; eventually, of course, the pressure between the outers will be raised to 400 volts and the consumers connected in the ordinary way again.

The transformer station is provided with several alternative systems of communication with the generating station, there being a system of signalling by means of a single stroke and a trembling bell, by telephone, and by a telescriptor, which last has the advantage that all communications are permanently recorded.

A similar transformer station has been erected by the Notting Hill Company at Bulmer Place, with a capacity of 700 kw.

The performance and development of the new system will be watched with great interest by all concerned in the general supply of electricity on a large scale. We may point out certain features of the installation as specially noteworthy:—The absence of stationary transformers, and the use of motor-generators in place of rotary converters; the high speed of the generators; the ample provision against breakdown in any part of the system, combined with extreme simplicity in the switch gear; and the comparatively moderate pressure used for the transmission.

In conclusion, we wish to express our thanks to Mr. H. W. Miller for his kindness in furnishing us with the information necessary for the preparation of this article, and affording us facilities for obtaining photographs, and at the same time to offer our congratulations on the success already attained. We are also indebted to many of the staff of the two companies—notably Messrs. C. M. Bennett, S. F. Weston, and C. L. Lichtenberg—for their courtesy and assistance.



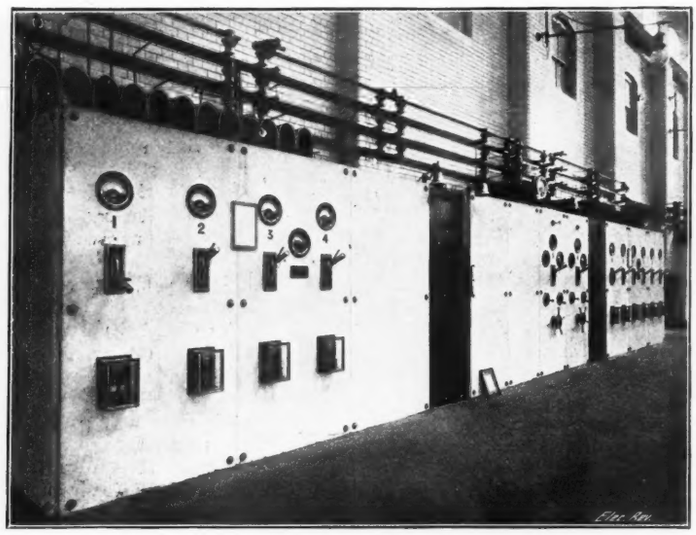
Switchboard, with Motor-Generator.

EXPERIMENTS IN WIRELESS TELEGRAPHY WITH THE GUARINI AUTOMATIC REPEATER.

BRUSSELS—MECHLIN—ANTWERP.

(*Continued from page* 968.)

WHILE carrying out his experiments between the Congress



KENSINGTON.—MAIN SWITCHBOARD.

Column at Brussels and St. Rombaut's Tower at Mechlin, M. Guarini made the following observations :—

Having substituted for the cylinder composed of 50 wires at Mechlin, a strand of 7 wires 1 mm. in diameter, the communication became uncertain, and the current had to be increased from 4 to 6 amperes (the current used in the experiments with the Mechlin station was throughout less than that used in the direct experiments) in order to keep the interchange of signals under as good conditions as in the previous trials.

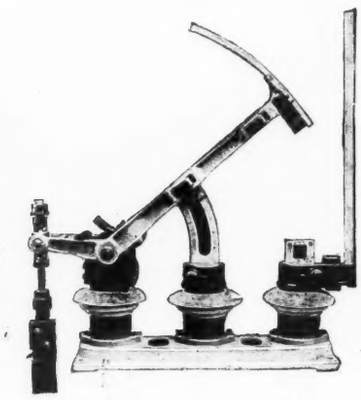
This proves that for the receiving antenna a large receiving surface is very advantageous.

Moreover, M. Guarini having substituted for the lower part of the antenna (consisting of a cable of seven wires) seven parallel wires 1 mm. in diameter, the signals were able to be received at Mechlin with a current of 3 amperes (without the cylinder of 50 wires at Mechlin).

M. Guarini thinks that the explanation of this phenomenon is to be found in his article on the part played by the antenna in wireless telegraphy (ELECTRICAL REVIEW, April 5th).

From this it can be seen, says M. Guarini, that a wire, or cylinder of wires, can be used advantageously for the transmitting antenna instead of a strand or cable such as has always, up to the present, been used for experiments in wireless telegraphy.

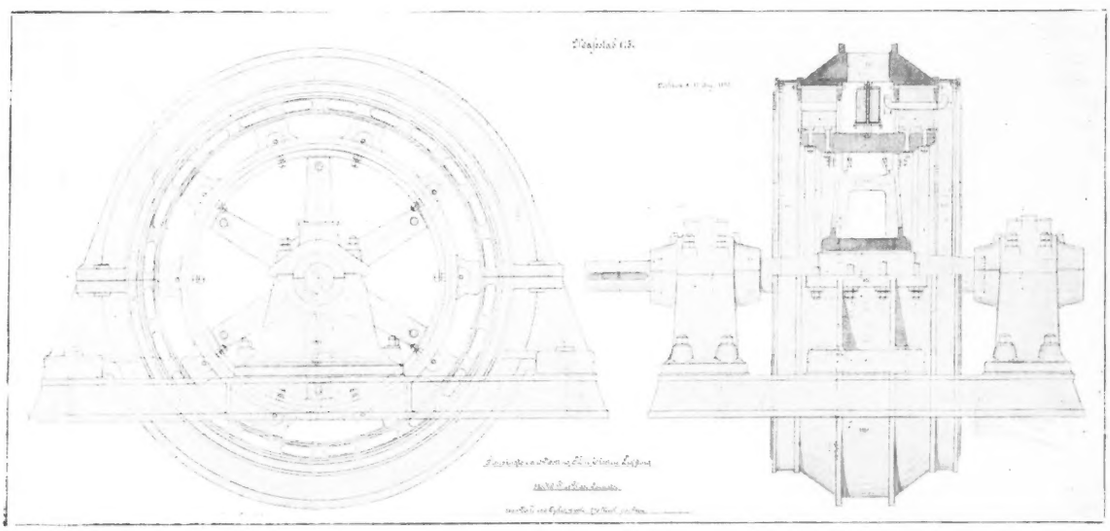
In the case where a cable or strand is used instead of a cylinder, the surface of the antenna is helicoidal instead of cylindrical. The surface enveloping the helix is really cylindrical, but this surface is only imaginary.



KENSINGTON.—DETAILS OF FUSE.

Now, the planes normal to the surface of the helix are not parallel to one another like the planes normal to the surface of a straight cylinder (figs. 15, 16, 17). They all cut one another. We thus get disastrous effects; interference on the one hand and diffusion in oblique planes on the other (fig. 18). It is this diffusion in oblique planes that allows of communication between two antennæ at different levels. Again, it is this diffusion in oblique planes that allows of communication between two antennæ on two moving vessels or between a ship in motion and the coast. This diffusion in oblique planes is disadvantageous for fixed stations on *terra firma*, but advantageous for moving stations.

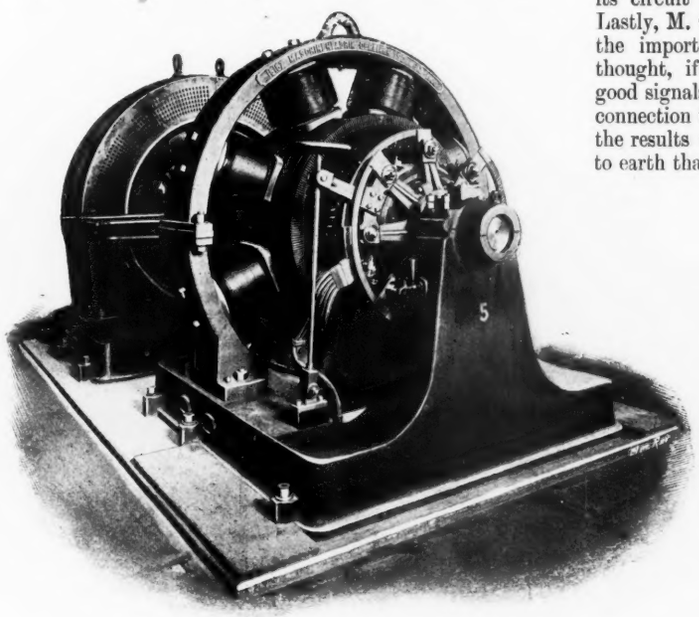
From these experiments and observations, M. Guarini concludes that the maximum effect between a transmitting and a receiving antenna is obtained by using as antennæ two straight metal cylinders of a certain height (length) and



KENSINGTON.—SECTIONAL VIEW OF THREE-PHASE GENERATORS.

a certain diameter placed parallel to one another. Supposing the two cylinders to be of equal length, each should be entirely comprised within the two planes passing through the bases of the other (fig. 19).

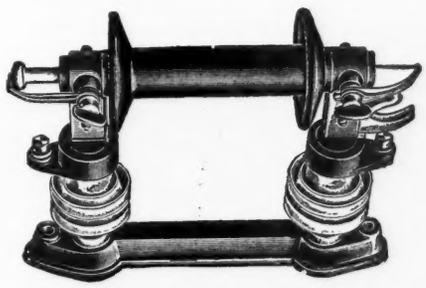
M. Guarini then reversed the experiment, Mechlin being the transmitting station and Brussels the receiving station.



Kensington.—Sub-station, Single Set.

The same instruments were used, but the antennæ were different. They had been broken by gales since the last experiment, and he profited by this circumstance to try antennæ of a different type.

At the transmitting station (Mechlin) he used the ordinary antenna with a simple cable, but at the receiving station (Brussels) the cylinder of 50 wires $\frac{4}{10}$ mm. in diameter, which before formed the upper part of the antenna, was replaced by a cone, the apex of which was turned towards the ground and connected with the instruments by a single wire. The cone was formed of 50 wires $\frac{4}{10}$ mm. in diameter. The simple cable going to the summit of the antenna crossed the cone following its axis (fig. 20).

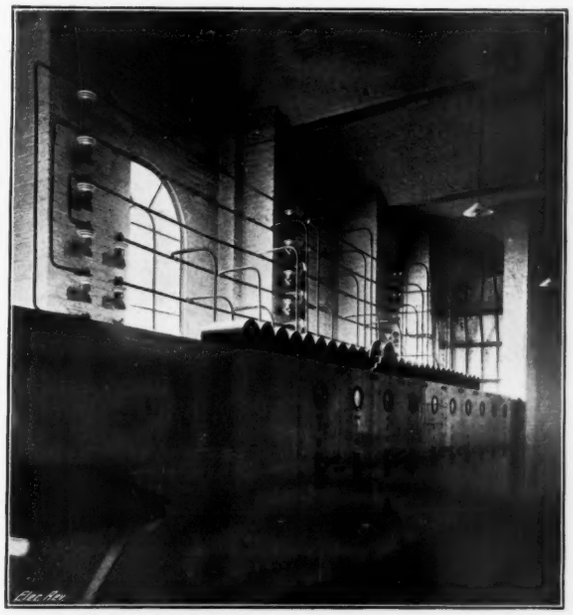


Kensington.—Details of Fuse.

At first the communication was bad. At Brussels M. Guarini received only a small proportion of the signals transmitted from Mechlin, whereas in the reverse way of communication he received at Mechlin all the signals transmitted from Brussels. A similar effect had, he says, already been observed at Paris, where in communications by wireless telegraphy between the Eiffel Tower and the Pantheon it was found that the tower acted very well as transmitter but gave no result as receiver. M. Guarini attributed this fact to the presence of masses of metal on the monument—viz., the bronze statue of Leopold I. at the top, the metal railing round the platform, the staircase inside the column, the statues on the base, &c. It was only by doubling the electrical power at Mechlin and by using an extra sensitive Blondel coherer at Brussels that he was able to effect a good transmission. He found, also, that the maximum effect was obtained when the antennæ were placed in such a manner that the vertical plane passing through them does not meet the supports from which they are suspended (fig. 21). Other experiments showed that the sensibility of the coherer for a certain wave was increased when the local current in its circuit was diminished by using suitable resistances. Lastly, M. Guarini made some experiments for determining the importance of the connection to earth. As may be thought, if none of the stations were connected to earth, good signals could not be transmitted; but with the usual connection to earth of the transmission station, he found that the results were better when the receiver was not connected to earth than when it was.

Kensington.—Details of Fuse.

M. Guarini thinks that the potential of the ball connect d with the antenna is increased by the earth connection, and determines the position of a point of maximum vibrations, at the top of the transmitting wire, for instance, the most conspicuous part of the receiving antenna, and that by insulating the coherer, we form a maximum of vibration at the point



Kensington.—Sub-station, H.P. Switchboard.

of the receiving antenna where the coherer is inserted. M. Guarini concludes that the earth acts as a large capacity, and not as a conductor, this capacity being advantageous to the transmitter, but detrimental to the receiver.

On February 12th M. Guarini experimented between Mechlin and Antwerp.

The transmitting station was at St. Rombaut's Cathedral, Mechlin, and the receiving station at the tower of the Cathedral

of Nôtre Dame, Antwerp. The apparatus used were the same as in the preceding experiments. The simple antenna was adopted without any capacity at the upper extremity.

Between the antennæ, in a straight line, there were, besides numerous houses in Mechlin and Antwerp, several villages and castles and undulating ground rising from 5 to

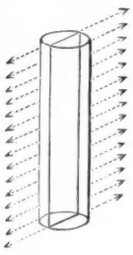


FIG. 15.

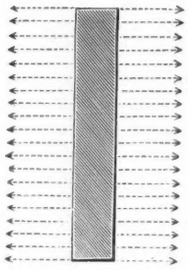


FIG. 16.

FIG. 17.

30 metres in height (fig. 22). The distance between the two antennæ was 22 km.

Good results were obtained by using at the transmitter a current of 2 to 2½ amperes.

On suppressing the connection to earth at the Antwerp receiver, the results were not so good as in the Brussels—Mechlin experiments.

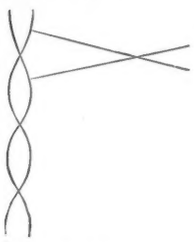


FIG. 18.

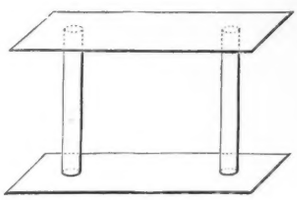


FIG. 19.

M. Guarini explains this by the absence of any capacity at the upper extremity of the receiving antenna in this case.

Another interesting observation may be mentioned. Having suppressed the oscillator at the Mechlin station, and having put the secondary of the bobbin in communication

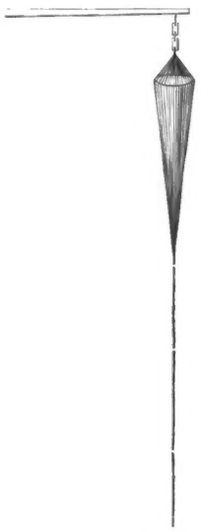


FIG. 20.

on the one hand with the earth, and on the other with the antenna, 12 signals were transmitted from Mechlin and three arrived at Antwerp.

M. Guarini thus claims to have realised (fig. 23) wireless telegraphy in conformity with Edison's American Patent, No. 465,971 of 1891, with this difference, that the receiver consists of a coherer instead of a telephone. A signal was even received without any connection to earth being used at the receiver at Antwerp (fig. 24).

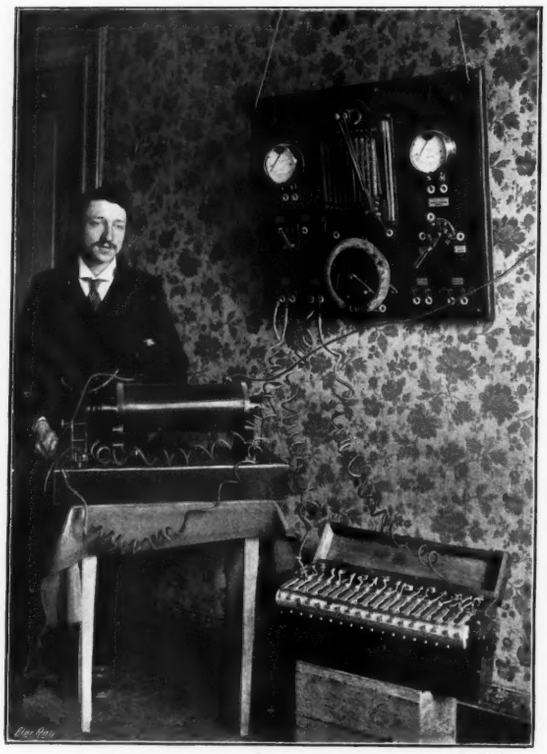


FIG. 27.

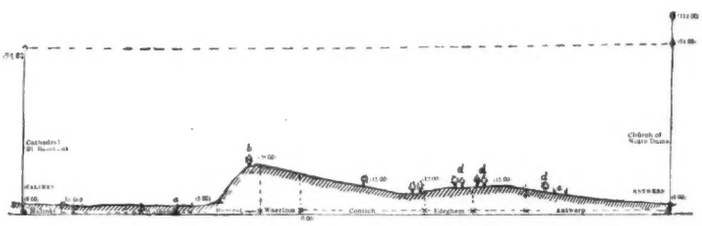
The Antwerp—Mechlin communication was not so good generally as the Mechlin—Antwerp one. M. Guarini attributes this to two causes :—

1. A very high wind which, by bending the antenna at Antwerp, destroyed all parallelism between the two antennæ.
2. The enormous masses of metal on the cathedral at Antwerp.

1, Cathedral St. Rombaut ; 2 and 3, Antennæ ; 4, Colonne du Congres.

FIG. 21.

As far as the first cause is concerned in the Mechlin—Antwerp experiments, the relative position of the antennæ was such that the receiving antenna at Antwerp was entirely comprised within the two planes perpendicular to the antenna at Mechlin and passing through its extremities



a, La Nethe; *b*, Route from Brussels; *c*, Railway; *d*, Wood; *e*, Enclosure.

FIG. 22.

(fig. 25), whereas in the Antwerp—Mechlin experiments, the two planes passing through the extremities of the antenna at Antwerp only reached one part of the antenna at Mechlin (fig. 26).

Signals were able to be exchanged by using at the transmitter simple alternating currents (fig. 23). In this case,

it was evidently expedient to add a capacity to the top of the transmitting antenna.

Signals were received at Mechlin by using the syntonisation apparatus (coils and condenser), although the transmitter and receiver were not at all in accordance. This proves, says M. Guarini, that to arrive at secret messages, it is not sufficient merely to have the receiver in accordance with the principal wave

$$T = 2\pi\sqrt{CL}$$

of a given transmitter placed at the limit of the transmitting distance, but for the solution to be complete, a

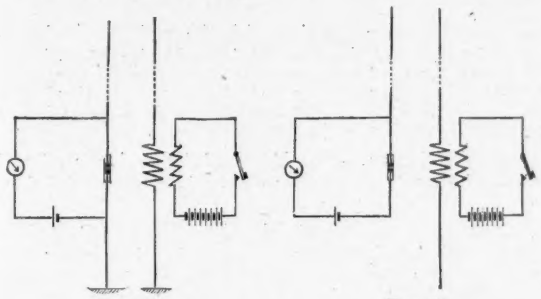


Fig. 23. Fig. 24.

kind of selection must be made at the transmitter so that it does not transmit secondary waves, but waves of one length with which the receiver will be in accordance.

Then the Brussels—Antwerp experiment was tried again, but with the receiver at Mechlin. Several signals passed between Brussels and Antwerp, and *vice versâ*, by the aid of the repeater at Mechlin. The transmission to the extreme stations was effected with Hertzian and alternating currents. The latter gave the better results. This is easily explained, by considering that 50 per cent. of the energy brought into play is dissipated in the form of heat and light in the electric spark.

In short, M. Guarini claims only to have furnished a proof of phenomena already discovered by other phenomena which have remained almost unperceived.

In 1885 his compatriot, Calzecchi Onesti, discovered the influence of alternating currents on metal filings. In 1891 Edison took out a patent for a system of wireless transmission of electrical energy, in which the transmitter produces only alternating currents. In his experiments, M. Guarini has applied to the receiver the discovery of Calzecchi Onesti, and to the transmitter, Edison's idea (fig. 27).

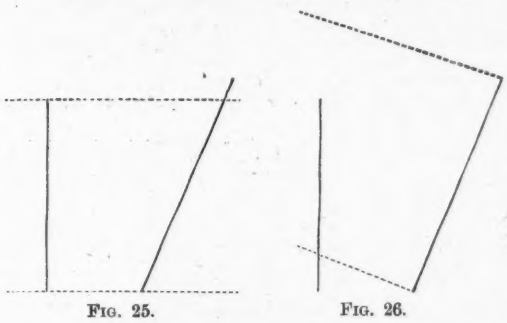


Fig. 25. Fig. 26.

The receiving and transmitting apparatus used at the extreme stations are the same as those used in the partial experiments. The tests were made with the collaboration of Lieut. Poncelet.

In all the laboratory experiments the repeater, says Lieut. Poncelet, had always worked well, even when the antenna was connected with the coherer through the medium of the armature of an interrupting electro-magnet (fig. 28), the object of which is, as we know, to cut automatically the communication of the antenna with the coherer when the transmitter works.

But when in the long-distance experiments between Brussels, Mechlin, and Antwerp, Messrs. Guarini & Poncelet tried this type of repeater at the Mechlin station, a singular thing happened: the repeater when once freed did not stop.

On comparing this fact with similar observations made at the receivers of the extreme stations of Brussels and Antwerp,

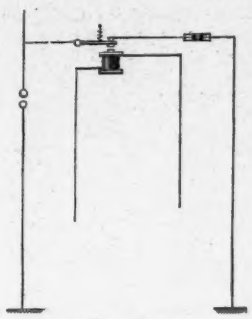


Fig. 28.

they thought that the cause might be attributed to atmospheric electricity.

(To be continued.)

ELECTRIC LIGHT AND POWER NOTES.

(*Continued from page* 1106.)

Plumstead.—The Callender Cable Company have nearly completed the work of cable laying in the district under their contract with the U.D.C.; the works having been taken over by the Woolwich M.B.C.

Pontypool (Mon.).—The Guardians have decided to write to electrical engineering firms asking their terms for laying down an electric plant for lighting the Workhouse buildings. The Board have steam power on the ground.

Rowley Regis.—The local authorities are negotiating for the provision of electricity for lighting and other purposes, and a distributing station will, it is stated, shortly be erected at Reddall Hill. The chairman of the District Council is reported to have stated that the Electrical Corporation will supply electricity for public lighting at much less cost than gas.

Shoreditch.—The House Committee of the Board of Guardians recently received a letter from the Renewable Electric Lamp Company, Limited, acknowledging an order for lamps to be sent to them and stating that it would be wise not to burn lamps more than 600 hours, after which a waste of current ensues and efficiency is diminished. The company offered to renew their lamps after 600 hours' use as half price, and the Committee recommended that the offer be accepted and the suggestion of the company acted upon.

Shrewsbury.—The T.C. is undertaking extensions of the street electric lighting. Application is to be made to the L.G.B. for a £16,526 loan.

Simla.—A Madras paper says that Mr. Meares, electrical engineer to the Government of Bengal, has reported on the question of the establishment of works for the electric lighting of Simla. The Nanti stream appears to have great advantages over the other streams, and will doubtless be used if the scheme is passed by Government. The estimated cost of the pumping plant is Rs. 1,17,420, and the cost for house wiring is estimated at Rs. 30 per light approximately. The estimate of the capital cost of the electric lighting scheme for Simla is Rs. 9,71,275.

Ventnor.—"The time has not yet come for purchasing the electric lighting undertaking." So reports the Committee to the U.D.C.

Wales.—Electric light is beginning to again tax public attention in Mid-Glamorgan and South Glamorgan. The Ogmore and Garw Valley Council—these Valleys are a big colliery centre—is making inquiries with a view to obtaining a provisional electric lighting order and eventually having the Garw lighted by electricity at Bridgend; it is understood that the Council, which some while ago secured a provisional order which it was unable to use, is negotiating with the South Wales Electrical Distribution Company.

Woolwich.—The M.B.C. is about to issue an exhaustive report on the completion of their negotiations for establishing electricity works. The Council took over the contracts entered into by the defunct Plumstead U.D.C., who had sealed contracts for plant to the value of £37,000. After delicate and prolonged negotiations, the Woolwich Electricity Company has agreed to sell their undertaking to the Council for £77,500. The capital expended by the company amounts to £47,817, and this and the recent very great increase in the company's business has been made the basis of the bargain. In 1899 the lamp connections increased from 4,810 to 9,610, and the following year again increased to 19,425, upon which the company declared a dividend of 5 per cent.

ELECTRIC TRACTION NOTES.

Blackburn.—The Electricity and Tramways Committee have adopted the proposal of Mr. Giles, the electrical engineer, to increase the tramway fares in order to meet the loss on the undertaking. The report issued last month on this subject showed the loss during the past year to have been £3,776 13s. 9d., but it now transpires that owing to a clerical error, the loss had been understated, the total deficiency being £5,221 2s. 5d. The town clerk, in announcing the decision of the committee to increase the fares, said that the loss had arisen owing to the committee endeavouring to give the public too much for their money, and the engineer assured him that there was no town in England of the same size and character as Blackburn, which had attempted to charge such small fares. The town clerk added that it would not be fair to charge the loss on the rates, the true principle being that each corporate undertaking must pay its way.

Bolton.—We are informed that on Saturday evening the head of a trolley on a car of the Bolton electric tramways became fast in one of the frogs and caused the fall of more than 100 yards of the overhead electric wire. No one was injured.

Bournemouth.—A deputation from the Corporation was recently sent to the Continent to study electric traction. At Brussels, information was obtained *re* the conduit system, which led the party to believe that it was a practical system, though extremely costly, so much so as to render it prohibitive from a commercial point of view, unless with very great traffic. From Brussels they went to Paris and saw the Diatto surface contact system and battery traction, which they gathered were far from satisfactory, the deterioration of the plant being great. Some conduit track, and combined trolley and conduit (with slot in rail) sections were examined. The result of this Continental tour was the following recommendations:—

1. That it is desirable to work the proposed tramways in Bournemouth on the conduit system through the main road of the town, namely, from the County Gates to the Ashley Road, Boscombe.
2. That it would be advisable to work this system on a double track throughout, and, in order to prevent complications, to avoid interlacing the lines and points as far as possible.
3. The additional cost of the conduit system over the trolley system was stated at Brussels to be about £2,000 per mile of single track, but the deputation cannot think it would cost less than £4,000 per mile additional in Bournemouth, considering the diversion of pipes, &c. In addition to this the system would involve some extra cost in cables, &c., at the generating station, but as to this the deputation advise that the consulting electrical engineers be instructed to prepare a report and estimate.
4. That application be made for sanction to borrow the additional sums required for carrying out the proposed works, and that tenders be obtained for the work forthwith.

The proposal to refer the recommendations in the report to the consulting engineers and the borough engineer for a report and estimate of cost, was unanimously approved by the Town Council at their last meeting.

Brighton.—The T.C. have increased the salary of Mr. Marsh, the assistant tramways engineer, from £125 to £160 per annum.

Chatham.—Operations for the construction of new tramways have been commenced at new Brempton, an artisan suburb populated entirely by Chatham dockyard men, naval and military representatives, and so on.

Croydon.—It is reported that the main routes of the Croydon County Council's tramway scheme will be ready for working in about three months' time.

Dewsbury.—It is expected that work in connection with the construction of electric tramways in the Dewsbury district by the British Electric Traction Company, will be commenced early in August.

Dundee.—Tenders for construction of permanent way for tramways have been opened by the Committee. That of J. M'Adam & Sons, of Aberdeen, at £13,000 was the lowest.

East Ham.—Mr. Trotter made a B. of T. inspection of the overhead wires and machinery in connection with the electric trams last week, and expressed himself satisfied. The license issued by the Chief Commissioner of Police is only now required to enable the Council to ply for hire. The electric cars started running on Monday.

Exeter.—Before the Exeter and District Chamber of Commerce on 19th inst. Mr. Philip Dawson read a paper on "Electric Traction." We make one quotation from the report in the local press: "Except in cases of weak heart or general weakness, 500 *bolts* were not fatal."

Germany.—The Berlin correspondent of the *Daily News* states that in the beginning of August experiments will be made on the military railway track from Berlin to Zossen for the projected electrical railways, with a speed of 122 miles an hour.

The starting of a service of electric motor omnibuses between Bilstein and Oedingen, Bavaria, is under consideration.

Heston—Isleworth.—The schemes of the Middlesex County Council and of the London United Tramways, Limited, respectively, for constructing light railways affecting the district, came before the U.D.C. on Monday evening, when lack of confidence was expressed in the County Council's scheme. It was decided that the chairman should attend a committee of the County Council for the purpose of obtaining particulars.

Hill of Howth.—The electric tram service between Sutton and the Hill of Howth, which has been constructed by the Great Northern Railway Company of Ireland to run in conjunction with their service of trains on the Howth line, was opened to the public on 17th inst.

Leeds.—A start has been made at Wellingboro' Bridge, Leeds, with the electrical equipment of the Wortley route.

Lees.—At the T.C. last week an early answer was asked for from Messrs. Hewitt & Rhodes as to whether the Oldham authorities would allow Lees to share the use of the Oldham tramlines or not. The scheme proposed by Hewitt & Rhodes for constructing trams through Lees and Springhead was generally approved by the Lees Council, who resolved to ask Springhead to meet them to discuss the same.

Leicester.—In connection with the visit of the Incorporated Association of Municipal and County Engineers to Leicester this week, Mr. Manville, who recently reported to the Council on electric traction, will read a paper on "Methods of Ensuring Safety with the Trolley System." The Brush Company's works at Loughborough will be visited by the Association to-day.

Light Railways.—The Board of Trade has confirmed the following light railway orders:—Barrowford (Lancaster), Nelson, Colne, and Trawden.

London.—It was reported by the Highways Committee at last week's L.C.C. meeting that notice had been received of applications having been made to the Light Railway Commissioners by the Middlesex County Council for powers to construct light railways (1) from the county boundary *viâ* Archway Road to the terminus of the North Metropolitan Tramways at the junction of Highgate Hill and Holloway Road, and (2) from the boundary at Cricklewood to join the Harrow Road and Paddington Tramways in Harrow Road *viâ* Edgware Road, High Road, Maida Vale, and Elgin Avenue. The report reminded the Council that powers were being sought in the Tramways and Street Widenings Bill of the present session for the construction of a tramway along the route covered by the first scheme, whilst the second proposal was practically included in the new tramway schemes about to be submitted to the Council. As the Council is the tramways authority for London, it appeared to the committee to be very undesirable for an outside authority to be permitted to construct tramways inside the county along routes that were essential portions of the tramway system of London. The Paddington Council were opposed to the Middlesex proposals, and were likely to view favourably the scheme of the London County Council for a tramway along the Edgware Road. Having regard to all the circumstances, the Council resolved to oppose the above mentioned application by the Middlesex County Council.

A special report by the Highways Committee was brought forward stating that consideration had been given to the question as to what further extensions of the tramways were desirable for submission in a Bill to be introduced in the next session of Parliament. The proposals, which were dealt with at considerable length, provide for the construction of new tramways of a total length of about 12 miles on the north side of the Thames, and for 16½ miles of lines on the south side of the river. It is estimated that the cost of the former, including the provision of car-sheds, the paving of the tracks, and other works in connection with the tramways, will amount to £435,200, apart from £185,400 required for street widenings; and that of the latter to £589,600 exclusive of £722,100 for the widening of the streets. It is proposed to ask the local authorities to contribute a total of £301,400 towards the cost of the street improvements, the amount to be thus received being estimated at about one-third of the net cost of the widenings. The following is a summary of the proposed new tramways:—

NORTH OF THE THAMES.—(1) Seven Sisters Road (existing lines) *via* Amhurst Park, to Upper Clapton Road (existing lines), 5 furlongs; (2) Chelsea Bridge (north end) *via* Grosvenor Road, to a point near Lambeth Bridge, 1 mile 3 furlongs; (3) Hampstead Road (tramways terminus), across Euston Road and along Tottenham Court Road, to a point near Oxford Street, 5 furlongs; (4) Edgware Road (from a point near the Marble Arch), to the county boundary at Cricklewood, 3 miles 6 furlongs; (5) Harlesden (near the county boundary) *via* Scrubbs Lane, Wood Lane, Shepherd's Bush Road, Brook Green Road and Fulham Palace Road, to Putney Bridge, 5 miles; (6) Uxbridge Road (near the railway station), *via* Richmond Road, Netherwood Road and Westwick Gardens, to Shepherd's Bush Road, 5 furlongs.

SOUTH OF THE THAMES.—(7)—A.—Clapham Common, south side (L.C.C. tramways) *via* Clapham Common, Battersea Rise, Wandsworth Common, north side, and East Hill, to West Hill; B—West Hill, *via* Kingston Lane, to the county boundary, 5 miles 3 furlongs; (8)—A—Deptford (L.C.C. tramways) *via* Blackheath Road and Hill and Shooter's Hill Road, to the Herbert Hospital; B—Herbert Hospital, *via* Woolwich Common Road, the road to the west of St. George's (garrison) Church into New Road, and thence along Thomas Street and Green's End, to Beresford Square, Woolwich, and returning along New Road and Mill Lane, to a point in Woolwich Common Road near Nightingale Place, 5½ miles; (9) New Cross Road (L.C.C. tramways) *via* Lewisham High Road, Loampit Hill and Vale, Lee High Road and Eltham Road, to a point near Wellhall Lane at Eltham, 4½ miles; (10) Streatham High Street (L.C.C. tramways terminus) *via* Streatham High Road, to the county boundary at Norbury, 1 mile 2½ furlongs.

It is proposed that those of the new lines which will be intimately connected with the tramways leased to the North Metropolitan Company shall be constructed for horse traction, unless, before the time arrives for carrying out the work, effect shall have been given to the provisions in the company's lease relating to the construction of these lines for electric traction. The estimates provide, however, for rails of sufficient weight to permit of their being used for electric traction when that system has been adopted on the leased tramways. Those of the new lines which will be connected with the County Council tramways, or which being for the present detached from either undertaking, could be worked independently of any other system of tramways, are proposed to be constructed for some method of electric traction to be approved by

the Board of Trade. The consideration of the report, which recommended the Council to apply for powers to construct the above-mentioned lines, was adjourned for a week.

After a long discussion, the London County Council this week resolved to apply for powers in the next session to construct various tramways north and south of the Thames of a total length of 28 miles. The expenditure involved by the proposals, including the widening of streets, is estimated at £2,026,800. It is proposed to construct the lines on the north of the Thames for horse traction, and those on the south for electric traction.

The London United Tramways Company made experimental trial runs over the extended portion of their line between Kew Bridge and Hounslow on Tuesday. This part of the system is expected to be opened to the public on July 1st.

Mersey.—It is stated in a Liverpool paper that it is now practically certain that the Mersey Railway will be worked by electricity by January, 1903.

Middlesex.—The inquiry by the Light Railway Commissioners for the new County Council scheme will take place at the Town Hall, Hounslow, on July 22nd, so far as the proposals affect Acton, Ealing, Brentford, and Chiswick.

Northfleet.—The D.C. is asking the National Electric Traction Company what is the minimum number of units it would take from the Council for the trams; also whether that Council is also to be asked to supply energy for the Swanscombe extension.

The National Company is applying to the Board of Trade for approval to the transfer of the undertaking from that company to "The Gravesend and Northfleet Electric Tramways, Limited," in consideration of the sum of £16,664, payable as to £11,664 in cash and as to £5,000 in fully paid-up shares of the last-named company.

Oldham.—The Electricity Committee last week had again before them the resolution of the Tramways Committee requesting the former to place the installation of plant being laid down at the station at the service of the latter. The matter was previously adjourned for the purpose of allowing the electrical engineer to supply further information as to the capabilities of the station. This was now supplied, and showed the Committee to be in a less favourable position than was at first thought. After a lengthy discussion it was decided to put all the surplus energy which was not required by present consumers at the service of the Tramways Committee for traction purposes. It was also decided not to take on any more new customers for electricity at present. The station will be worked to its fullest capacity, and should a breakdown occur a section of the tramways will be temporarily stopped, the Committee being of the opinion that present consumers should not be interfered with in respect to their supply. We are informed that the above resolution will mean a loss of new orders for at least 18 months. If this be true, it is to be deeply regretted and is a lamentable state of affairs. Excavations are now going on at the Greenhill site for the new station.

Rowley Regis.—At the last U.D.C. meeting it was stated that the British Electric Traction Company intends constructing a tramline from Dudley through Rowley to Blackheath. It is also proposed to make a line from the tramway at Old Hill to Oldbury, and communicating with Dudley and Birmingham. It was resolved that the Council would not in any way join the Dudley scheme for a line through Rowley to Blackheath.

S.E.R. and Monorail.—The S.E.R. secretary says that, although a monorail scheme has been before the engineer at different times, the project mentioned in our last issue has not been under the consideration of the directors.

Sunbury.—At the meeting of the U.D.C. on Monday, it was decided to oppose the Middlesex County Council's light railway scheme on the following principal grounds:—

1. That the proposed time of completion of the work should be altered from five to two years, and the penalty for non-completion should be the same as that applying to the L.U.T. scheme.
2. That at various points along the proposed route from Park Road to the Shears Inn it would be necessary to widen the Staines Road in order to lay a double line.
3. That the proposed passenger fares should be altered to 1d. a mile.
4. That purchase clauses should be inserted, allowing purchase by the local authority in 25 years (as suggested to apply to the L.U.T. scheme).

It was also decided to oppose a similar scheme of the London United Tramways, Limited, on the following grounds:—

1. That the Middlesex County Council propose to continue their double line to Staines, while the company do not propose to bring their line in this direction further than the corner of Park Road.
2. That the line of the company would turn at Park Road into Hanworth parish, and that this line should instead be continued to Sunbury Cross.
3. That the double line in Park Road could not be constructed without widening Staines Road at various points.
4. That the company only proposed to lay single lines in places where the County Council scheduled double lines.
5. That the fares for passengers should be altered to 1d. a mile.

The Council will be represented by counsel at the Commissioners' inquiry at Hounslow on July 22nd.

Thanet.—A Board of Trade inquiry was held at Margate last week by Major Pringle, R.E., into the recent accidents which have occurred on the Isle of Thanet electric tramways.

Tramways and Light Railways Association.—The annual dinner, it has now been arranged, shall be held in Glasgow in September. Mr. A. H. Gibbings's paper, to be read before the B.A. will be entitled "The Carriage of Goods over Electric Trolley Systems." The official circular of the Association for June announces the acceptance of the invitation given to the Union Internationale Permanente de Tramways in July (1st to 4th), 1902.

Wolverhampton.—The Lorain Steel Company (America) has sent a cablegram stating they are willing to accept the contract to lay down their surface-contact system in connection with the Corporation tramways "with certain verbal alterations." A meeting of the Tramways Committee will be held to consider the matter.

The British Electric Traction Company is about to reconstruct the tramlines from Willenhall to the Wolverhampton boundary.

Woolwich and Greenwich.—The Borough Councils are both opposing the application of a private company for light railway powers to construct a line to Eltham and Bexley, and the London County Council, which will ultimately acquire the existing tramlines to Woolwich and Greenwich, has been asked to prepare an extension scheme in the directions named.

TELEGRAPH AND TELEPHONE NOTES.

Brighton Telephones.—The committee reported having received a letter from Mr. J. E. Dell stating that the Southwick Urban District Council had passed the following resolution, viz.:—"That the request of the Brighton Corporation for permission to construct overhead telephone circuits in this district be granted, provided all wires crossing the tramway be taken underground, that the maximum charge to a subscriber in the district does not exceed £5 10s. per annum, and also that in no case shall a larger sum be charged in this district than in Brighton." Councillor Carden wrote requesting the committee to consider the desirability of making an application to the Postmaster-General to include Hayward's Heath within the area, and suggesting that inquiries should be made of the Urban District Council of Hayward's Heath as to whether they would support such an application. The town clerk was instructed to communicate with the Urban District Councils of Hayward's Heath and Cuckfield asking them if they were desirous for their districts to be included in the Brighton telephone area, and in the event of their being so, whether they would support the necessary application by the Brighton Corporation to the Postmaster-General. The Town Council resolved that the terms of the Southwick Urban District Council be deferred for further consideration, and that Mr. Bennett be requested to prepare a map showing an extension of the Brighton area to embrace Hayward's Heath and Cuckfield and the adjoining rural districts, including Lindfield and Wivelsfield, also that the Postmaster-General be asked if he would be prepared to extend the Brighton telephone area so as to include the Urban Districts of Hayward's Heath and Cuckfield and the adjacent rural area.

Cable License.—The Board of Trade will consider next month an application from the American Telegraph and Cable Company and the Western Union Telegraph Company for the renewal of their license for maintaining and using telegraph cables from America at Sennon Cove, Cornwall.

Consumption in the Post Office.—The reply given by the Secretary to the Treasury to the request of Sir Walter Foster, M.P., reported in our last issue, has caused considerable disappointment and not a little surprise. "It would be difficult," said Mr. Austen Chamberlain, "to give all the details referred to, but it may suffice to say that the average annual number of deaths from phthisis in the past three years was 47, and the average number of established officers (men) in the United Kingdom in those years was 52,146, showing a death rate of ·9 per 1,000 living. He had not been able to obtain the figures for women, but he believed their mortality was considerably lower." In reply to further questions, Mr. A. Chamberlain said he would submit to the Postmaster-General the desire that the details should be included in the annual report. The question of superannuations was lost sight of altogether in the reply. The medical journals express grave dissatisfaction at this reply. We understand that the matter will form the subject of a paper to be read in the Section of State Medicine at the British Congress on Tuberculosis, which takes place in London on July 22nd and the five following days. The author of the paper has collected a large mass of statistical detail from official and unofficial sources, and has also received very valuable assistance from Dr. Mignot, surgeon to the French Postal Administration, who was a member of the French Commission on Tuberculosis, and was instructed by M. Millerand, the French Minister of Commerce, to draw up a report on Tuberculosis in the French Post Office, and the means to be adopted for its prevention. It is felt to be a matter that deserves more than the meagre attention it now receives in the report of the Postmaster-General, and in the hygienic regulations of the English postal department.

New French Cable.—The *Morning Post* Paris correspondent states that the French cable from Tangier to Oran was opened for public use on June 23rd. He adds that the French colony of Tangier is congratulating itself on being freed from the necessity of using foreign cables.

Police Telephone Service.—In the opinion of Mr. Ritchie, the present system of telegraphic communication between London police stations meets all police requirements.

New Telephone Exchange at Berlin.—On Friday, June 21st, the new chief trunk line exchange at Franzosiche Strasse, Berlin, for the exclusive interurban and international telephone communication, was opened. The system now in use means a considerable step forward in the development of telephony in Germany, for while up to now all trunk lines to Berlin terminated there, and could not be brought into connection with each other, the new trunk line exchange enables the combining of any trunk line wires, thereby providing the means of allowing telephonic intercommunication between not less than 17,000 towns all over Germany. This reorganisation naturally required an enormous amount of new work and reconstruction, and the whole of the work connected therewith was carried out by Messrs. Mix & Genest, Limited, of Berlin, by whom this line exchange has been specially designed. We understand that this exchange has had a preliminary trial at the trunk telephone exchange at Chemnitz, and we are informed that, during the short time of its introduction, it has shown such superior reliability, and such decided acceleration of service that the General Post Office decided upon its adoption on a larger scale for Berlin, and has now also ordered the trunk line exchange at Magdeburg and Halle to be fitted up after the same plan.

South African Telegraphs.—In his report on the local trade for 1900, the British Vice-Consul at Inhambane states that the telegraph line to Lourenco Marquez has been interrupted for long intervals during the past year, and for all practical purposes the line is useless to business men, as it is impossible to depend upon it, and this state of things will continue until the much-needed iron posts are exchanged for the present rotten wooden posts. A new telegraph lines is about to be commenced to the north from Maxixe, on the other side of the Bay, *viâ* Marrombéne, Massinga and Villanculos. Eventually this line will probably be continued as far as Beira, but unless iron poles are employed as supports for the wires, it will be as unreliable as the present line to Delagoa Bay.

Submarine Telephonic Experiments.—The *Morning Post* Paris correspondent states that at Calais on Saturday M. Maiche, an electrical engineer, succeeded in transmitting a telephonic message with perfect distinctness through a submarine cable 600 kilometres long.

Telegraphic Communication between Italy and England.—Reuter's correspondent at Rome says that the Italian Government has proposed to Parliament to vote a credit enabling it to lay two bronze wires from Genca and Milan respectively to the French border, by means of which telegraphic communication between Genoa and London and Milan and London can be established. The same Bill proposes also a credit of 51,000 lire for the construction of an international telephone line between Italy and Switzerland.

Telegraphic Interruptions and Repairs :—

CABLES.	INTERRUPTED.	REPAIRED.
Latakia-Cyprus	June 20, 1899 ..	..
Para-Maranham	March 1, 1900 ..	..
Gibraltar-Tangier	June 11, 1901 ..	June 18th
LANDLINES :—		
Bolama Bissao	May 19, 1901 ..	..
Cayenne-Pinheiro	April 20, 1901 ..	..
Pekin-Kalgan	June 14, 1900 ..	..
Maimatchin-Kalgan	June 30, 1900 ..	..
Moulmein-Bangkok	June 18, 1901 ..	June 20th

Tunbridge Wells Telephones.—In view of the coming municipal competition, the National Telephone Company is said to have announced that its terms will be reduced from £8 10s. to £4.

It is further stated, we do not know with what truth, that the National Company intends giving an "unlimited service for 1d. a day."

Wireless Telegraphy.—Reuter's Halifax, N.S., correspondent says that the Canadian Government is installing the Marconi wireless system in the Gulf of St. Lawrence, and the steamer *Tyrian* has been dispatched to establish the first station at West Point, Anticosti. The *Tyrian* will also lay for the Government a cable 22 miles in length connecting Belle Isle with the Government line to Quebec. This will be a great convenience for steamers bound up the River St. Lawrence.

The *Daily Mail* correspondent at Ostend stated under date June 24th :—"It is understood here that owing to climatic and other hindrances the Marconi wireless telegraph plant used by the Army in South Africa has not turned out an entire success. The British attaché for Belgium and the Netherlands, Colonel C. à Court, acting under instructions from his Government, has consulted M. Guarini, who, as a result of his wireless telegraphy between Brussels, Mechlin, and Antwerp, now holds the record for the land system. A special commission, consisting of Major Carr and Captain Speranza, has been to Brussels to see M. Guarini, who has arranged a special adaptation of his retransmitter for Army purposes."

The *Times* states that the Admiralty have just ordered 54 sets of wireless telegraphy gear, to be made according to their own specifications and system. The work, which has been divided among Messrs. Siemens Bros., Messrs. Newton, and Mr. H. W. Sullivan, is to be completed within three months. The Central News says that the delicate part of the work has been placed with Mr. Sullivan.

The *Standard* correspondent at Berlin says that the result of the inquiry, made by order of the German Postmaster-General, into the various systems of wireless telegraphy, is that the Schäfer system is pronounced to be superior to all others, owing to its simplicity and great sensitiveness. The report concludes as follows :—

"From the beginning of last April extensive experiments have been made at Bremerhaven with the Schäfer system of spark telegraphy. The Imperial Telegraph Administration sent an official, specially trained in receiving telegrams by the sound, to take part in the experiments, and the North-German Lloyd lent its steamer *Seeadler*. The results were a perfect communication between the coast station near Bremerhaven and the ship, which steamed as far as Meyers Reef, a distance of 24 kilometres from Bremerhaven. The experiments justified the hope that satisfactory communication between Bremerhaven and Rothersand, a distance of 42 kilometres, may be achieved. The telegrams are received with a telephone. The signals can, however, be transferred to a Morse apparatus if desired.

"From the present state of spark telegraphy in Germany, it may be said that the German systems can completely replace the Marconi one; but the incompleteness of practical experiments prevents any real decision as to the best German system."

CONTRACTS OPEN AND CLOSED.

OPEN

Bermondsey.—July 1st. The Borough Council wants tenders for electricity meters, demand indicators, and main fuses. See "Official Notices" June 7th.

Birkenhead.—July 16th. The Corporation wants tenders for 15 electric car bodies, also equipments, trucks and trolleys. See "Official Notices" June 21st.

Bradford.—July 4th. The Corporation wants tenders for electric motors (enclosed) of 4½, 7, and 10 H.P. See "Official Notices" June 21st.

Brazil.—July 8th. The Foreign Secretary has received a despatch from H.M. Consul-General at Rio de Janeiro, stating that tenders are invited by the Brazilian Government, to be received not later than July 8th, for the supply of electrical machinery for the hoisting and transporting of locomotives at the Engenho de Dentro Works. Some particulars may be examined at the Commercial Department of the Foreign Office.

Brecon.—August 5th. Tenders are invited for electrically lighting the Brecon and Radnor Joint Asylum now erecting at Talgarth. See "Official Notices" to-day.

Cleckheaton.—July 6th. The Council wants tenders for Lancashire boilers, economiser, condenser, pumps, Meldrum's furnaces, balancers and boosters, battery, cables, switchboards and travelling crane. See "Official Notices" to-day.

Colne.—July 5th. The Technical Committee wants tenders for a 6 B.H.P. "protected" motor, &c. See "Official Notices" to-day.

Darlington.—July 16th. "Free" or "assisted" wiring proposals are wanted by the E.L. Committee. See "Official Notices" June 21st.

Dublin.—July 1st. The Corporation wants tenders for wiring and fitting for fire signalling apparatus, switchboard, internal wiring and fire alarm bells, in connection with the new district fire brigade station, Upper Dorset Street. Tenders to the City Hall.

Dudley.—July 6th. The E. L. and T. Committee wants tenders for a steam engine and dynamo. See "Official Notices" June 21st.

Durham.—June 29th. The Brandon and Byshottles U.D.C. is inviting tenders for poles, lamps, &c., for the public electric lighting of the West Ward. Tenders to Mr. J. G. Wilson, 5, North Bailey, Durham.

Erith.—July 1st. The U.D.C. wants tenders for Lancashire boilers, economiser, pumps, piping, condensing plant, steam alternators (high speed engines, three-phase alternators), switchboard, crane, transformers, sub-stations, mains and road work, arc lamps and posts, and station lighting. See "Official Notices" June 7th.

Exeter.—June 28th. The Council wants tenders for water-tube boilers, steam alternators, switchboards, coaling apparatus, tanks, &c. See "Official Notices" May 10th.

Italy.—June 30th. The municipal authorities of Pacentro (province of Aquila) are inviting tenders until the 30th inst. for the establishment of a central station in the town for public and private lighting purposes.

Kirkcaldy.—July 20th. The Corporation wants tenders for feeders, mains, road work, and arc lamps. See "Official Notices" to-day.

Manchester.—July 1st. The Tramways Committee wants tenders for rail bonds. See "Official Notices" June 21st.

Mansfield.—July 12th. The Corporation wants tenders for Lancashire boilers, stokers, pumps, economiser, 200-KW. steam generators, motor transformers, condensing plant, switchboard, battery, crane, mains, arc lighting, meters, and workshop equipment. See "Official Notices" June 7th.

Nelson.—July 1st. The Corporation wants tenders for steam engine and dynamo, balancer, Lancashire boilers, pumps, economiser, condenser, piping, cables, and switchboard for electric lighting and traction. See "Official Notices" June 21st.

Pontypridd.—July 23rd. The Guardians want tenders for electric lighting at the Union Workhouse, Infirmary, and other buildings. Particulars from, and tenders to, Mr. W. Speckett, Clerk, Union Offices.

Poplar.—July 1st. The Electricity Committee wants tenders for condensing plant, feed pump, piping, &c. See "Official Notices" June 21st.

Poplar.—July 2nd. The Electricity Committee wants tenders for multiple core lead-covered feeder and network cable and accessories. See "Official Notices" June 14th.

Russia.—The *Board of Trade Journal* says that the Municipality of Mariupol is still open to receive tenders for the construction and working of an electric tramway, and the installation of electric light in that town. Some particulars may be examined on application at the Commercial Department of the Foreign Office, any day between the hours of 11 a.m. and 5 p.m. The British Vice-Consul at Kertch also reports that the contract for electric lighting and tramways in that town has not yet been given out. Some particulars may be examined at the Commercial Department of the Foreign Office as above.

Shoreditch.—July 10th. The Borough Council wants tenders for switchboards and instruments for its stations and sub-stations. See "Official Notices" to-day.

Southwark.—July 10th. The E.L. Committee wants tenders for two new panels for the main switchboard. See "Official Notices" to-day.

Spain.—July 9th. Tenders are being invited until July 9th, by the Municipal authorities of Riaza (Segoria province), for the concession for the electric lighting of the town during a period of 20 years. Tenders to be sent to El Secretario del Ayuntamiento de Riaza (Segoria), whence particulars may be obtained.

Spain.—The Municipal authorities of Cacabelos (province of Leon), have just invited tenders for the concession for the electric lighting of the town during a period of 20 years.

Spain.—The *Board of Trade Journal* says that the *Madrid Gazette* of the 16th inst. contains a notice inviting proposals under certain conditions to be sent in within 60 days for the establishment and working of a municipal electrical power house in Cadiz. The *Gazettes* containing the above notices may be seen at the Commercial Intelligence Branch of the Board of Trade, 50, Parliament Street, S.W.

Stepney.—July 18th. The Borough Council wants tenders of steam and other pipe works, paper cables, conduits, &c. See "Official Notices" to-day.

Sweden.—The Municipal authorities of Wisby are at present inviting tenders for the establishment of a central electric lighting station in the town.

West Hartlepool.—July 3rd. The Corporation wants tenders for single cables. See "Official Notices" June 21st.

CLOSED.

France.—The French Post and Telegraph Authorities in Paris have just placed a contract to M. Grammont, of Pont-de-Cherug (Isère), for 20 kilometres of lead-covered telephone cable.

Holland.—Tenders were lately invited by the South Holland Electric Railway Co., of The Hague, for the supply of 3,600 tons of steel rails. Twelve concerns competed for the order, the lowest tender being that of the Rheinische Statlwerke Gesellschaft, of Ruhrort, Germany, who quoted 59¾ fl. per ton delivered in Rotterdam. Messrs. C. Cammell & Co., of Sheffield, were the next lowest, their price being 60 fl.

Poplar.—The Hart Accumulator Co. is to supply a new storage battery for the electricity works at £1,200, and £90 for five years of maintenance.

Spain.—The Barcelona Tramways Co. have placed a large order for masts required in connection with the electric tramways of the Société Francaise de Tubes, of Louvroil, France.

FORTHCOMING EVENTS.

Friday, June 28th.—5 p.m. At Wheatstone Laboratory, King's College, Physical Society Meeting. "The Effect of a a High Frequency Oscillatory Field on Electrical Resistance," by Mr. S. A. F. White; "The Spectrum of Cyanogen," by Mr. E. C. C. Baly and Dr. H. W. Syers.

Thursday, July 4th.—At 8.30 p.m. Röntgen Society. Annual general meeting at 20, Hanover Square. Mr. G. Bowron will show an Oscillometer for measuring the Current and Oscillations in the secondary circuit of an induction coil or similar apparatus.

NOTES.

With the Institution of Electrical Engineers in Germany.—Those members of the Institution who elected to travel in company assembled on Saturday last at Liverpool Street station with the ladies who are taking part in the tour, and proceeded by special train to Harwich; the passage to the Hook of Holland was, happily, most favourable, the sea being as smooth as could be wished. The last section of the journey—that by train from the Hook to Hanover—was the least enjoyable, owing to the heat and dust, and afforded but a poor preparation for the functions which were to follow. Soon after their arrival in Hanover the party paid a most interesting visit to Messrs. Korting's works, calling at the City Electricity Works on their way back. Finally, the visitors were entertained at a banquet given by the city of Hanover in their honour in the most handsome and sumptuous manner. On the following day (Monday) the party visited the central electrical station of Berlin, and were treated to an interesting demonstration of the Nernst lamp by their hosts for the day—the A.E.G., well known to British engineers through their London representatives, the Electrical Company. A high-pressure station and a sub-station were afterwards visited. In the evening the A.E.G. held a reception at the Exhibition of Life-saving Apparatus and Fire Protection, and the guests were entertained to an excellent supper and an interesting display of fire drill. On Tuesday Messrs. Siemens and Halske took the party by steamer to their extensive cable works, and afterwards to their dynamo works at Charlottenburg, luncheon being served *en route*. The party then divided, a number going to the Imperial Telephone Exchange, while the majority inspected the experimental high-speed railway and the Wannsee Electric Railway—altogether an extremely full and most interesting day's work.

Presentations.—A meeting of the outdoor employés of Messrs. Drake & Gorham's Manchester branch took place last week, when Mr. William Cotsworth was presented with an address and handsome silver salver on the occasion of his resignation to take up important electrical undertakings for the Calico Printers' Association, Limited.

On June 21st the staff of the Leeds Electric Lighting Department presented Mr. A. C. Ivimy, the mains superintendent, with a valuable timepiece on the occasion of his marriage. The chief engineer, Mr. H. Dickinson, in making the presentation, referred to Mr. Ivimy's long connection with the department, he having been connected with it since the commencement of the undertaking.

On 22nd inst. Mr. Vesey Brown was presented with a handsome tobacco cabinet by the staff of the Lincoln electricity works, on the occasion of relinquishing the chief engineership.

Prior to his departure from Cape Town on a brief holiday in the old country, Mr. G. B. Stacey, of the Eastern Telegraph Company's local station, was presented by his colleagues with a piece of plate, as a slight token of their esteem. The presentation was made by Mr. J. C. Evans, who incidentally mentioned that Mr. Stacey had been very hard worked lately and needed a rest. He trusted that the temporary retirement from active service would do him any amount of good, and soon restore him to health and strength.

Cranes for the Westinghouse Works.—Messrs. Craven Bros., Limited, of Manchester, have received an order from the British Westinghouse Electric and Manufacturing Company, Limited, for eight electrically-driven overhead travelling cranes for their new workshops in Trafford Park. This is said to be first important order placed with an English firm for any part of their equipment at Trafford Park.

Technical Education.—The Technical Education Board of the London County Council is making arrangements at the Poplar Technical Institute for giving practical instruction in the use of nautical instruments, and in marine engineering. Practical classes will be conducted in electrical engineering, especially in connection with ship lighting.

The Civil Engineers' Conversazione.—The annual conversazione of the Institution of Civil Engineers took place in the well-known building at Great George Street on the 19th inst. Everything possible was done for the entertainment of the guests. Instrumental music was discoursed by the string band of the Royal Artillery, and vocal music under the direction of Mr. William Coates. A magic lantern exhibition of views illustrating a tour round Kancheujinga, in the Himalayas, was given by Mr. E. J. Garwood; followed by projection on the same screen of views of the Great Nile Dam by Sir Benjamin Baker. During the evening the telegraphone, the telautograph, and the electrophone amused and interested the guests to a degree only equalled by the disgust with which their barbarous names are viewed by the grammarian. A fine loan exhibition of paintings and drawings were on view on the walls of the rooms and corridors of the building. A considerable number of engineering models and scientific apparatus were also on view. Models of the *Turbinia's* and of the *Viper's* engines (in action) were exhibited by the Hon. C. A. Parsons, which, owing to the extraordinary speeds attained by vessels fitted with the steam turbine, excited a good deal of interest. The action of the Schattner electric prepayment meter was clearly shown by the model exhibited by Mr. Wallis-Jones; a humane feature of this invention is that it turns the consumer's lights half down as a warning to him to find another coin. An electrostatic system of measuring alternating currents was exhibited in action by Mr. Addenbrooke. Mr. de Segundo exhibited an interesting model for controlling the speed of the jet water turbine. Mr. Chaney, of the Standards Department, Board of Trade, showed a number of metric standards and instruments for testing the accuracy of standards. Our want of space prevents us mentioning many other exhibits equally worthy of notice.

A Chance for Investors.—A correspondent who is acquainted with a little country village of about 120 houses, chiefly workmen's, but including the Squire's Hall, and several others larger than the average, with three places of worship, sends us a rough plan of the neighbourhood showing its compactness. He adds: "There is a gas works, but the company is at its last gasp. The mill owner would, I believe, grant facilities at a moderate charge for water-power in the mill: a very little expense need be incurred to put down electric power, and so far as I am aware, there is plenty of power for all purposes at all times of the year. The place will not grow, for local reasons. Overhead bare mains could be used. I wish to know whether anyone would be willing to invest capital in a lighting scheme for this place, as, if so, I would be glad to be put into communication with an intending investor. I can give full particulars if anyone feels sufficiently interested."

Personal.—The Lighting Committee at Brighton having reported that Mr. C. Fowler was returning from South Africa after serving in the war, the terms of his engagement as assistant engineer were considered. The town clerk reported that Mr. Fowler was entitled under the terms of his agreement with the Corporation to be kept on until March 2nd, 1902, at the salary of £350 per annum. Mr. Wright, the consulting engineer, was instructed to arrange for Mr. Fowler to resume duties on his return to Brighton.

Mr. George Carter, of St. Helens, has been appointed resident electrical engineer at Heckmondwike.

The deputy-controllership of the Central Telegraph office, London, which was rendered vacant by the death of Mr. Thomes Barlow, has been filled by the appointment of Mr. E. Trenam. Mr. Trenam held the position of chief superintendent for telegraphs at Manchester until November last, when he was appointed to one of the newly-created posts of traffic managers for telegraph business.

Mr. J. W. Cawthra, borough electrical engineer at Swansea, has been appointed borough electrical engineer at South Shields, in place of Mr. Jeckell, who, as already announced, goes to Coventry.

Mr. J. C. Whiteley, late of Halifax, has been appointed chief assistant to Mr. H. M. Thomas, electrical engineer at the Huddersfield Tramways power station.

Appointments Vacant.—In consequence of the resignation of Mr. O. M. Jonas, electrical engineer to the Dewsbury Corporation, the Corporation has decided to advertise for a successor at a salary of £250 per annum, advancing to £300. Mr. Jonas's salary was advanced to £350 in January last. A switchboard attendant is wanted for Devonport Corporation electricity works. The Ealing D.C. wants a clerk for its Electric Lighting Committee. An assistant lecturer and demonstrator is wanted in the electrical engineering department at the Croydon Polytechnic. A resident electrical engineer is wanted for Swansea.

Cylindrical Boilers in the Navy.—From the *Pall Mall Gazette* "Service Notes" we quote the following:—

As a contribution to the present controversy regarding boilers it is worth while to record a recent performance of the second-class cruiser *Hermione*, fitted with cylindrical boilers. The story is told by a correspondent of the *Naval and Military Record*. The *Hermione* was at Hong Kong when, at 10 o'clock at night, the order was received to have steam up for full speed by six o'clock the following morning. Two of the boilers were empty and open; the fire bars were out of four of the furnaces; one boiler was in use for auxiliary purposes; five of the boilers were completely full of water; no fires were laid; the main condensers were empty; and important portions of the gear were in the dockyard for repair. By a quarter past 10 the full steaming watch for eight boilers had mustered below. The missing gear was fetched from the dockyard in a half-finished condition, and fitted in the best way possible under the circumstances. Everything needful was carried out as quickly as it could be. By midnight the centre fires were lighted in all boilers. At a quarter past five the engines were moved with steam from all eight boilers. Thirty-five minutes later the ship was under way. By seven o'clock she was making about 16½ knots, and she covered 448 miles in 25 hours, making an average of 18 knots for the greater part of the journey, though at times she exceeded that by a knot. Surely this is a tribute to the merit of the cylindrical boiler as well as to the smartness of the crew.

Manchester Supply Difficulties.—The difficulties of the Manchester electricity department have been increased by the fact that manufacturers and others who have made application for the current and been refused will in future take action in order to compel the Committee to supply.

Society of Arts.—The Council have awarded the Society's silver medal for the following readers of papers during the Session of 1900—1901:—Fritz B. Behr, for "The Proposed High-Speed Electrical 'Monorail' between Liverpool and Manchester"; Guglielmo Marconi, for "Syntonic Wireless Telegraphy"; Lieut. Carlyon W. Bellairs, R.N., for "The Coal Problem: Its Relations to the Empire."

Obituary.—The death is recorded, on June 13th, of Mr. G. T. Watkins, local manager of the Deptford district of the National Telephone Company.

CITY NOTES.

The British Electric Traction Company.

THE directors' report to be presented to the fifth ordinary general meeting to be held at Hamilton House, Victoria Embankment, E.C., on Thursday July 4th, reads as follows:—"The directors beg to submit their report and statement of accounts for the year ended March 31st, 1901. The profits, including £43,783 18s. 10d., brought forward from last year, amounted to £157,382 17s. 7d. This does not take into account the premiums, amounting to £128,855 2s. 5d. received in respect of new share and debenture capital, and which have been carried direct to reserve. After deducting the proportion of general expenses chargeable to revenue, and also the expenses incurred in connection with schemes not proceeded with and written off, contributions to superannuation fund and interest on debenture stock, there remains a net profit of £116,947, which the directors propose should be applied as follows:—

Reduction of goodwill account	£2,500	0	0
Reduction of licenses and testing of new systems account	2,500	0	0
Reduction of furniture account	366	14	6
Dividend at the rate of 6 per cent. per annum on the preference shares for the year ended March 31st, 1901, including the dividend paid to February 15th, 1901, and proportion of dividend payable August 15th, 1901, accrued to date	34,256	7	11
Dividend at the rate of 12 per cent. per annum on the ordinary shares for the half-year ended March 31st, 1901, making with interim dividend at the rate of 6 per cent. per annum, paid for the half-year ended September 30th, 1900, a total distribution of 9 per cent. for the year ..	55,866	12	0
Carried forward to next account..	21,457	5	7
	£116,947	0	0

A large part of the capital expenditure on construction of new lines and other works has only lately commenced to earn revenue, over 45 miles of new or reconstructed tramways and light railways having been opened for traffic since the interim report to the shareholders in November last. In accordance with the intention expressed in the last report, the directors issued in June, 1900, 15,000 ordinary shares and 10,000 preference shares to the shareholders at the price of £13 per ordinary share and £11 per preference share. In February last 30,000 preference shares were offered to the public, at the price of £11 10s., and were fully subscribed. This issue was guaranteed jointly by Messrs. J. S. Morgan and Co., and the Electric and General Investment Company, Limited, without commission, in consideration of an option given to them by the company to call for allotment of the whole or any part of the unissued share capital of the company during the period of eight months from February 15th, 1901, upon the following terms:—(*a*) As to preference shares (ranking for dividend with the preference shares previously issued) at the price of £11 10s. per share, together with an additional amount equal to the accrued dividend on an existing preference share; (*b*) as to ordinary shares at the price of £13 per share, less a deduction at the rate of any further dividend paid upon the existing ordinary shares of the company for the year ending March 31st, 1901, unless such option should have been exercised prior to the declaration of such dividend. A further 2,074 ordinary shares have been issued as fully paid up to the holders of 15,555 ordinary shares of the Brush Electrical Engineering Company, Limited, in exchange for their shares in the Brush Company. There has also been issued £250,000 5 per cent. perpetual debenture stock. The total premiums received in respect of these issues, after deducting the expenses, amount to £128,855 2s. 5d., and the whole of this amount has been added to reserve, which now stands at £338,520 13s. 4d. The subscribed share and debenture capital is now:—

£620,740 in ordinary shares of £10 each.	
£900,000 in 6 per cent. cumulative preference shares of £10 each.	
£600,000 5 per cent. perpetual debenture stock.	
£2,120,740	

Of the authorised share capital there is at present unissued 37,926 ordinary shares of £10 each and 10,000 preference shares of £10 each, but Messrs. J. S. Morgan & Co. and the Electric and General Investment Company, Limited, have signified their intention to exercise their option to take up the whole of the unissued capital. The issued capital will then be £2,000,000 in shares, and £600,000 in debenture stock, with power to the directors to issue a further £400,000 in debenture stock.

The total amount expended under the head of contracts and undertakings, after deducting the cost of undertakings transferred, and after writing off expenses incurred in respect of schemes not proceeded with, but including a proportion of general expenses, is £626,333 13s. 11d., made up as follows:—

Expenditure and profit on works and undertakings for account of other companies	£315,335 2 7
Expenditure on works and undertakings owned or leased by the B.E.T. Company and for general stores ..	236,643 12 4
Expenditure on negotiations, &c., in connection with schemes in course of development, and on Acts of Parliament, provisional orders, light railway orders, and other rights or powers secured or in course of promotion	54,314 19 0
	£626,333 13 11

The total expenditure under the head of investments, after deducting cost of securities sold, is £1,349,130 8s. 5d., and is made up as follows:—

Consols .. .. cost	£102,901 10 3
Loans and advances to associated companies and others	73,105 10 10
Mortgages, debentures and debenture stock, and shares of associated and other companies [including £24,940 in the B.E.T. (Pioneer) Co., Limited] .. .. cost	1,173,123 7 4
	£1,349,130 8 5

N.B.—There are certain contingent liabilities in respect to some of these investments. A portion of the Consols is deposited with the Paymaster-General and with local authorities in respect of Acts, provisional orders, &c.

The British Electrical Superannuation Fund was duly established on July 1st last, but it is only since January 1st last that it has been a condition of service that all new members of the company's staff shall join the fund. At the present date the membership is over 60, while 23 associated companies and undertakings have signified their intention to contribute to the fund on behalf of their salaried staffs. In accordance with the powers conferred on the directors by the shareholders at the last ordinary general meeting, the sum of £1,117 14s. 10d. had been contributed by the company up to March 31st. The directors have had under their consideration the question of facilitating the best investment of sums set aside from time to time by the associated companies and undertakings, to provide sinking funds against eventual loss of capital upon compulsory purchase and for renewals of permanent ways and plants. The directors recommend the establishment of an associated sinking fund, to be under the control of trustees nominated by this company. The B.E.T. Company will deposit with the trustees interest-bearing securities sufficient to produce at specified dates a sum equal to the amount set aside, together with compound interest at a rate to be agreed, not exceeding 3½ per cent. Arrangements will also be made with insurance companies under which associated companies desiring to have the additional security of an insurance company's policy can obtain the same, the rate of interest allowed in such cases being smaller. Mr. C. Shirreff B. Hilton has been appointed a director of the company, and Mr. J. S. Raworth has been appointed a managing director under Article 85*b* of the articles of association, with the title of technical director. The directors who retire this year are the Rt. Hon. Lord Rathmore and Mr. Charles S. Drummond, and both are eligible for re-election. Messrs. Fred W. Smith & Co. retire, and offer themselves for re-election."

Reports concerning the different companies in which the B.E.T. Company has an interest accompany the statement, and form a bulky appendix.

List of Investments at March 31st, 1901.

Name of Company.	Shares. At par value. £ s. d.	Debentures. At par value. £ s. d.
B.E.T. (Pioneer) Co., Ltd.	19,952 0 0	
Birmingham and Midland Tramways, Ltd. ..	101,420 0 0	
Buenos Ayres & Belgrano Tramways Co., Ltd.	5,000 0 0	
Birkdale and Southport Tramways Co., Ltd...	1,600 0 0	
British Thomson-Houston Co., Ltd.	33,250 0 0	
Brighton and Shoreham Tramways Co., Ltd.	10,000 0 0	
Bideford, Westward Ho! and Appledore Railway Co...	36,510 0 0	7,800 0 0
Brush Electrical Engineering Co., Ltd. ..	57,494 0 0	
Cork Electric Tramways & Lighting Co., Ltd.	14,170 0 0	2,000 0 0
City of Carlisle Electric Tramways Co., Ltd.	2,000 0 0	
Dudley, Stourbridge and District Electric Traction Co., Ltd...	185,120 0 0	
Electrical Power Distribution Co., Ltd. ..	33,080 0 0	
Gateshead and District Tramways Co... ..	52,450 0 0	500 0 0
Hartlepool Electric Tramways Co., Ltd. ..	40,260 0 0	
Immisch Electric Launch Co., Ltd.	10,139 10 0	
Kidderminster and District Electric Lighting and Traction Co., Ltd.	30,460 0 0	
Leicester Tramways Co.	2,323 0 0	
Mumbles Railway and Pier Co., Ltd.	2,000 0 0	
McKirdy & McMillan, Limited	3,750 0 0	
Nelson Electric Tramway Co.	44,330 0 0	
Oldham, Ashton and Hyde Electric Tramway, Ltd.	5,220 0 0	8,100 0 0
Potteries Electric Traction Co.	105,930 0 0	
Poole and District Electric Traction Co., Ltd.	14,670 0 0	
Rossendale Valley Tramways Co., Ltd... ..	27,570 0 0	
Rothesay Tramways Co., Ltd.	5,770 0 0	
South Staffordshire Tramways Co., Ltd. ..	150 0 0	47,350 0 0
South Staffordshire Tramways (Lessees) Co., Ltd.	48,285 0 0	
Swansea Improvements and Tramways Co. ..	248,650 0 0	1,150 0 0
Southport Tramways Co., Ltd.	17,270 0 0	
South Shields Tramway & Carriage Co., Ltd.	6,500 0 0	
Tynemouth and District Electric Traction Co., Ltd.	33,815 0 0	
Tramways & Light Railways Estates Co., Ltd.	5,002 0 0	
Wigan and District Tramways Co., Ltd. ..	2,985 0 0	
Worcester Tramways, Ltd.	11,455 0 0	4,679 12 8
Weston-super-Mare, Clevedon and Portishead Tramways Co.	—	3,000 0 0
Yarmouth and Gorleston Tramways Co., Ltd.	20,000 0 0	
	1,239,437 10 0	74,579 12 8
Thirty-two sundry other investments	18,090 0 0	295 0 0
	1,257,517 10 0	74 874 12 8
	£1,332,592 2 8	
The above stand in the company's books at a cost of		£1,173,123 7 4
Add—Consols at cost		102,901 10 3
		£1,276,024 17 7

A portion of the consols is deposited with the Paymaster-General, and with local authorities, in respect of Acts, provisional orders, &c.

United River Plate Telephone Company.

The report of the directors for the year ended March 31st states that the gross receipts in sterling for the year in the River Plate were £109,540, as against £101,169 for the year before, and the working expenses in London and the River Plate, £55,514. After deducting debenture interest and interim dividends on preference and ordinary shares, and adding transfer fees and interest on investments, there remains a profit of £34,929, to which must be added the sum brought forward from the previous year, leaving an available balance of £39,949. After writing off the whole of the cost of the last issue of preference shares and transferring the sum of £15,000 to reserve fund, the directors recommend that a final dividend of 4½ per cent. be paid upon the ordinary share capital of the company, making, with the interim dividend paid in December last, a return of 7 per cent. for the year, and that the balance of £6,058 be carried forward.

Prospectus.

The prospectus of the Urban Electric Supply Company appears in our advertisement pages to-day. The company, which exists for the purpose of carrying out electric lighting and tramway undertakings for a number of towns for which powers have already been obtained, has a nominal capital of £500,000 in 50,000 5 per cent. £5 preference, and 50,000 £5 ordinary shares. The works will be constructed by Edmundson's Electricity Corporation, Limited, the character of whose past operations is perfectly familiar to readers of the Electrical Review, and Mr. F. E. Gripper of that company is chairman of the Urban Electric Supply Company. Mr. F. H. Medhurst is consulting engineer of the company. The list closes to-morrow in an issue of 30,000 each ordinary and preference shares. We observe that a dividend of 5 per cent. on the preference, and a minimum dividend at the same rate on the ordinary shares, have been guaranteed until December 31st, 1910, by Edmundson's Corporation.

Stock Exchange Notices.—The committee has appointed special settling days as under:—Thursday, June 27th. Charing Cross and Strand Electricity Supply Corporation, Limited—Provisional certificates (fully and partly paid) for £250,000 4 per cent. debenture stock. Wednesday, July 3rd. Ruston, Proctor & Co., Limited—Further issue of 10,000 shares of £10 each, fully paid, Nos. 25,001 to 35,000. The Committee has also ordered the undermentioned securities to be quoted in the Official List:—British Columbia Electric Railway Company, Limited—Further issue of 6,400 non-cumulative 5 per cent. preference shares of £10 each, fully paid, Nos. 38,601 to 45,000. Charing Cross and Strand Electricity Supply Corporation, Limited—Provisional certificates (fully paid) for £250,000 4 per cent. debenture stock. Ruston, Proctor & Co., Limited—Further issue of 10,000 shares of £10 each, fully paid, Nos. 25,001 to 35,000.

Coming Issue.—At the annual meeting of Messrs. Royce, Limited, electrical engineers, Manchester, powers were vested in the directors to make a public issue of 30,000 £1 cumulative preference shares for further extensions.

Electric Construction Company.—The 4 per cent. debenture stock transfer books will be closed from 1st to 14th prox., and for the ordinary and preference shares from 27th inst. to 11th prox.

Liverpool Overhead Railway Company.—Mr. James Barrow having resigned his position as a director, Mr. Harvey C. Woodward has been elected to a seat on the board.

British Electric Traction Company.—The transfer books of the ordinary shares will be closed from 27th inst. to 10th prox., inclusive.

TRAFFIC RECEIPTS.

Blackburn Corporation Tramways.—The receipts for the week ending June 21st were £487; corresponding week last year, £482; increase, £5. Total to date, £11,583, corresponding period last year, £10,542: increase, £1,011. Miles of track open, 8½.

Blackpool and Fleetwood Tramways.—The receipts for the week ending June 22nd were £592; corresponding week last year, £633: decrease, £31. Total to date, £9,016; corresponding period last year, £9,402; decrease, £386.

Bristol Tramways and Carriage Company.—The receipts for the week ending June 21st were £4,377; corresponding period last year, £3,201; increase, £1,176.

Central London Railway.—The receipts for the week ending June 22nd were £6,262; previous week, £6,239; increase, £23. Total receipts to date (25 weeks), £155,082. Miles open, 6.

City and South London Railway.—The receipts for the week ending June 23rd were £1,900; corresponding week last year, £1,500; increase, £400. Total to date, £48,971; corresponding period last year, £32,235; increase, £16,736. Miles open, 4¾.

Dover Corporation Tramways.—The receipts for the week ending June 22nd were £225 15s. 8d.; corresponding week last year, £216 2s. 10d.; increase, £9 12s. 10d. Total to date, £4,614 5s. 8½d.; corresponding period last year, £4,2-8 9s 6½d.; increase, £325 16s. 2d. Miles of track open, 3. Car miles run, 1901, 5,106; 1900, 5,024. Number of cars, 11.

Dublin United Tramways Company.—The receipts for the week ending June 21st were as follows:—D.U.T. Co., electric cars, £3,834 8s. 0d.; D.S.C. Co., electric cars, £930 13s. 3d.; total, £4,765 1s. 3d.; corresponding week last year—D.U.T. Co., electric cars, £3,670 4s. 10d.; ditto, horse cars, £61 1s. 5d.; D.S.D. Co., electric cars, £956 1s. 9d.; total, £4,687 8s. 0d.; increase, £77 13s. 3d.; aggregate to date, £102,659 10s. 10d.; aggregate to date last year, £103,102 3s. 10d.; decrease, £722 13s. 0d. The mileage worked is 45 miles electrically, as against 42 miles electrically, and two miles by horses, for the corresponding period last year.

Glasgow Corporation Trams.—The receipts for week ending June 22nd were £11,898 9s. 8d., compared with £9,773 19s. 3d. for the corresponding period last year.

Liverpool Overhead Railway.—The receipts for the week ending June 23rd were £1,572; corresponding week last year, £1,606; decrease, £34. Total to date, £39,295; corresponding period last year, £35,820; increase, £3,465. Miles open, 6 miles 57 chains.

STOCKS AND SHARES.

Wednesday Evening.

THE lassitude of summer is stealing over investment markets of the Stock Exchange, and the number of bargains diminishes daily. This is the cry of the broker as well as that of the jobber, and such being the case it is useful to discard our usual weekly gossip of the markets in favour of the little retrospection which the end of the half-year naturally suggests. The period has been one of immense unrest at home and abroad. Few things have made for the happiness of the investor, whose holdings he has seen wane under the lead of consols and other of the most gilt-edged securities. War, and rumours of war, have brought their regular concomitant of dear money; with all the anxiety dependent upon that, and the political atmosphere of unrest, has not failed to cloud the commercial sky. Therefore, we are prepared, at all events, to find no startling improvement in our summary.

But the figures shall speak for themselves. We will take the important electrical supply section first:—

Company: Ordinary shares.	Price. Dec. 31, 1900.	Price. June 25, 1901.	Rise (+) or fall (−).
Charing Cross and Strand ..	10	9½	− ½
Chelsea	6⅜	6	− ⅜
City of London	9½	9	− ½
County of London	9	9	—
Edmundson's	4⅜	5⅛	+ ¾
Metropolitan	12½	14	+1½
Notting Hill	15	16	+1
St. James's and Pall Mall ..	15½	15½	—
Westminster	13	12½	− ½

The abnormal prices ruling during the latter half of 1900 for fuel and materials were responsible for a batch of somewhat disappointing dividends. Only two or three of the supply companies succeeded in improving upon the previous distributions, but the reports gave hopeful indications of better things when outside markets resumed more normal conditions. A capital sign that shareholders regard their electrical investments with confidence, is to be found in the fact that all the new issues offered by the various boards were fully subscribed. The number of new emissions, principally of Debenture stocks and Preference shares, has been large, but the demand for them proved that they were very acceptable, which is not always the way, by any means.

The little electric railway market, after furnishing subjects for endless interest amongst all classes of the community, winds up the half-year very much as it started in the new century. For instance, Central London Ordinary on December 31st, 1900, closed at 9½, while the Preferred Half shares were 5, and the Deferred Halves 4½. We now find them unchanged, with the exception of the Deferred Half shares, which have risen a half notwithstanding all the pessimistic talk that was indulged in concerning the vibration question, the rolling-stock difficulties, and the extra burden imposed upon the earnings by a new issue of Debenture Stock. Waterloo and City began 1901 at 95½; it is now 94½. City and South London Stock dipped to 45 on the appearance of a poor dividend. This was nine points below the quotation six months ago, but it has now recovered, and will finish the half-year in the neighbourhood of 56. The Underground stocks, despite such progress in the idea of electrification, are still left severely alone by the investor. Metropolitan Consolidated from 83 has fallen to 75, but District Ordinary at 30 compares with 29½, thanks in some degree to the harlequin-like appearance of Mr. Yerkes from Chicago.

The telegraph companies' list displays several points of interest. First must be noticed the curious inflections that have taken place in Amazon 5 per cent. Debentures. The last dividend on these was paid exactly two years' since, but the price kept about 87, until at the end of May it suddenly tumbled below 60. An equally rapid advance then took place, upon what grounds it is hard to ascertain. Glancing at the comparisons of the representative stocks, this is what we find:—

Company: stocks or shares.	Price. Dec. 31, 1900.	Price. June 25, 1901.	Rise (+) or fall (−)
Amazon Debs.	87½	80½	−7
Anglo-American "A"	10½	10½	—
Do. "B"	98	99	+1
Direct Spanish	4	3⅛	−⅞
Eastern	138½	142½	+4
Eastern Extension	14¼	13⅝	−⅝
Great Northern	32	31	−1
West India and Panama ..	⅜	¼	−⅛
Globe Telegraph and Trust ..	10½	10	−½

Violent speculations in American rails led at one time to a sharp jump in Anglo "A," which was languishing in disfavour after the reduction of the dividend from the 27s. per cent. paid last year to the 5s. paid a few months back. But the demand subsided after the crash in Yankees. The Eastern division still suffers from the fears of what the all-British cable may bring about when its competition starts. West India and Panama securities are discredited in the market upon the passing of the Preference and Ordinary dividends.

Coming to the miscellaneous markets, British Electric Tractions owe at least part of their rise from 14 to 15 to the veiled hand of American financiers. The company's issue of new shares was successfully made, and there is now a fairly free market in them. National Telephones started the century at 4⅜, but the bogey of Government competition led to so much selling that the price has sunk to 3½. Curiously enough, there was a slight advance after Mr. Austen Chamberlain's statement that the Government lines should be ready for work in August or September. Telegraph Constructions at 38 are lower than they were on December 31st, 1900, when Telegraph Manufacturing stood at 10½, the price at which they now stand.

From this brief summary one comforting reflection stands boldly forth. If the finance of electrical enterprise can hold its ground with so slight a retrocession in times of all-round dulness, it can safely be relied upon to give a good account of itself when the next cycle of prosperity comes to the stock markets.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1898.	1899.	1900.	Closing Quotations June 19th.	Closing Quotation June 26th.	Business done during week ended June 26th, 1901. Highest.	Lowest.
96,900	African Direct Telegraph, 4 % Debs	100	...	...	...	100 —103	100 —103	...	...
119,700£	Amazon Telegraph 5 % Debs., Nos. 1 to 1,200 Red.	100	...	...	...	78 — 83	78 — 83	...	...
822,700£	Anglo-American Telegraph	Stock	£3 9s.	73/6	3½%	53 — 56	53 — 56	...	...
3,088,540£	Do. do. 6 % Pref	Stock	6 %	6 %	6 %	98 —100	98 —100	99½	98
3,088,540£	Do. do. Deferred	Stock	18s. %	£1 7s.	5s.%	10¼— 10¾	10 — 10½	10½	10 1/16
44,000	Chili Telephone, Nos. 1 to 44,000	5	3 %	4 %	...	3½— 4	3¾— 4¼	3½	3 1/16
3,333,300$	Commercial Cable	$100	8 %	8 %	...	175 —185	175 —185	...	...
1,589,496£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	101 —103	101 —103	102½	101¾
16,000	Cuba Telegraph	10	8 %	7 %	...	7 — 8	7 — 8	7	...
6,000	Do. 10 % Pref.	10	10 %	...	...	14½ — 15½	14½ — 15½	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	4 %	3 — 4	3 — 4	...	...
6,000	Do. do. 10 % Cum Pref.	5	...	...	...	9 — 10	9 — 10	...	...
30,000£	Do. do. 4½ % Debs.	50	...	...	...	100 — 104%	100 —104%	...	...
60,710£	Direct United States Cable	20	3½%	3 %	3 %	10½— 10¾	10½— 11	10 1/16	10¾
108,300£	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	100 —103	100 —103	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	...	140 —145	140 —145	143½	142½
1,826,888	Do. 3½ % Pref. Stock	100	...	...	...	90 — 93	90 — 93	91½	90
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	...	...	...	109 —113	109 —113	110½	...
300,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	7 %	13½— 14	13½— 14	13⅞	13⅝
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	111 —116	111 —116	...	...
300,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	...	...	...	100 —103	100 —103	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	...	...	...	100 —103	100 —103%	...	...
180,227	Globe Telegraph and Trust	10	5¼%	5¼%	...	9¾— 10½	9¾— 10½	9 13/16	9¾
180,042	Do. do. 6 % Pref.	10	6 %	...	...	14¾— 15½	14¾— 15½	15⅛	14⅞
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	...	15 %	31 — 33	30 — 32	...	...
82,000£	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	100 —103	100 —103	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	43 — 47	43 — 47	...	...
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	...	...	...	103 —106	103 —106	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680 ...	1	...	2½%	...	¼— ½	¼— ½	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	4 %	5 %	...	½— 1	½— 1	...	...
590,000	National Telephone, 1 to 590,000	5	6 %	5 %	5 %	3½— 3¾	3 — 3¼	3 3/16	3 1/16
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	11 — 12	11 — 12	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	11 — 12	11 — 12	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	4¼— 4½	4 — 4¼	4⅛	...
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	89 — 92	89 — 92	...	...
500,000£	Do. 4 % Deb. Stock Red.	100	...	...	4 %	95 — 98	96 — 99	98	96½
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	5 %	6 %	¾— 1	¾— 1	⅞	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	...	...	...	100 —103	100 —103	...	...
11,839	Reuter's	8	5 %	5 %	5 %	7 — 8 xd	7 — 8	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	125 —130	125 —130	...	...
58,000	United River Plate Telephone	5	6 %	7 %	...	5 — 5½	5 — 5½	5 5/16	5¼
40,000	Do. do. 5 % Cum. pref. Nos. 1—40,000	5	...	...	...	4¾— 5¼	4¾— 5¼	...	...
179,947£	Do. do. 5 % Debs.	Stock	...	...	...	103 —106	103 —106	105½	...
171,000	West African Telegraph, 5 % Debs....	100	...	...	...	98 —101	98 —101	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	¼— ⅜	¼— ⅜	...	...
150,000£	Do. do. 4 % Debs., 1—1,500 gua. by Braz. Sub. Tel.	100	...	...	...	100 —103	100 —103	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	13¾— 14¼	13¾—14¼	14⅛	13⅞
75,000£	Do do. 5 % Debs. 2nd series, 1906 ...	100	...	...	...	102 —105	102 —105	...	...
348,777£	Do. do. 4 % Deb. Stock Red.	100	...	...	...	102 —105	102 —105	...	...
88,321	West India and Panama Telegraph	10	2 %	5%	...	⅜— ⅝	⅜— ⅝	...	...
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	...	...	...	5 — 6	5 — 6	...	...
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	...	...	...	3 — 5	3 — 5	3¼	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	...	...	...	103 —106	103 —106	...	...

ELECTRICITY SUPPLY COMPANIES.

19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	6 %	6 %	6 %	7⅞— 8¼	7⅞— 8¼	...	...
12,000	Do. do. 7 % Cum. Pref....	5	...	...	...	8½— 9	8½— 9	...	...
50,000	Charing Cross and Strand Electricity Supply	5	8 %	9 %	9 %	9 — 10	9 — 10	...	...
20,000	Do. do. do. do. 4½% Cum. Pref.	5	...	...	...	5½— 5⅝	5½— 5⅝	...	...
34,000	*Chelsea Electricity Supply, Ord.	5	6 %	6 %	5½%	6 — 6½	5⅝— 6¼	6⅛	...
150,000£	Do. do. do. % Deb. Stock Red. ...	Stock	...	...	...	109 —112	109 —112	...	...
70,579	City of London Electric Lighting, Ord. 40,001—110,579...	10	6 %	4 %	0 %	8½— 9½	8½— 9½	8 9/16	8½
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	12½— 13½	12½— 13½	...	...
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	122 —127	122 —127	...	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	*nil*	4 %	4 %	8½— 9½	8½— 9½	...	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	11½— 12½	12 — 13	12½	...
200,000£	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Rd. ...	...	...	...	...	105 —108	105 —108	...	...
35,500	Edmundson's Elec. Corp., Ord. Shares	5	6 %	6 %	...	5¼— 5¾	5¼— 5¾	...	...
20,000	Do. do. 6 % Cum. Pref.	...	...	...	...	5¼— 5¾	5¼— 5¾	...	...
120,000£	Do. do. 4½ % 1st Mort. Deb. Stock. ...	100	...	...	...	104 —107	104 —107	...	...
21,000	Kensington and Knightsbridge Electric, Ord.	5	...	...	...	11½— 12¼	11½— 12¼	...	...
90,000	Do. do. do. 4 % Deb. Stock	Stock	...	...	...	102 — 105	102 —105	...	...
110,000	London Electric Supply Corporation, Limited, Ord. ...	3	...	...	...	1¼— 1⅝	1¼— 1⅝	...	...
49,840	Do. do. do. do. 6 % Pref.	5	6 %	...	...	4 — 5	4 — 5	...	...
250,000£	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	96 —100 xd	96 —100	...	...
85,000	Metropolitan Electric Supply, 101 to 62,500	10	5 %	5 %	6 %	13⅛— 14⅛	13⅛— 14⅛	14⅛	13¾
220,000£	Do. 4½% First Mortgage Debenture Stock	...	...	...	...	110 —113	110 —113	...	...
250,000£	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	96 — 99	96 — 99	...	...
6,452	Notting Hill Electric Lighting	10	6 %	7 %	7 %	15½— 16½	15½— 16½	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	15 — 16	15 — 16	15⅝	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8½— 9½	9 — 10	9¼	...
150,000£	Do. do. 3½ % Deb. Stock Red. ...	100	...	...	...	98 —101	98 —101	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	2 — 2½	2 — 2½	...	...
50,000£	Do. do. 4 % Deb.	100	...	...	...	80 — 90	80 — 90	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	2½— 3½	2½— 3½	...	...
79,900	Westminster Electric Supply, Ord., 101 to 80,000... ...	5	12 %	13 %	10½%	12 — 13	12 — 13	12½	12⅛

* Subject to Founders Shares.
Unless otherwise stated all shares are fully paid.
‖ Dividends marked ‖ are for a year consisting of the latter part of one year and the first part of the next
Quotations on Liverpool Stock Exchange.
‖ Dividends paid in deferred share warrants, profits being used as capital.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1898.	1899.	1900.	Closing Quotation June 19th.	Closing Quotation June 26th.	Business done week ended June 26th, 1901. Highest	Lowest
20,000	British Aluminium 7 % Cum. Pref.	10	...	...	...	7½ — 8½	7½ — 8½	...	...
300,000*l*	Do. do. 5 % 1st Mort. Deb. Stock Red. ...	Stock	...	...	...	85 — 93	89 — 93	...	...
45,000	British Electric Traction	10	6 %	8 %	9 %	15 — 16	14½ — 15½	15 7/16	15 1/16
50,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12 — 13	12 — 13	12 9/16	12 3/8
350,000*l*	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	121 —124	122 —125	124	123 5/8
70,000	British Insulated Wire Ord.	5	15 %	20 %	15 %	9½ — 10½	9½ — 10½	...	...
70,000	Do. do. 6 % Cum. Pref.	5	...	...	...	5⅝ — 6⅝	6 — 6½	6¼	...
90,000	Brush Elecl. Enging., Ord., 1 to 90,000	2	5 %	6 %	...	1⅝ — 1⅞	1⅝ — 1⅞	...	...
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000 ...	2	6 %	6 %	...	2⅛ — 2⅜	2⅛ — 2⅜	...	...
125,000*l*	Do. do. 4½ % Perp. Deb. Stock	Stock	...	...	...	103 —108	103 —108	...	...
108,710*l*	Do. do. 4½ % Perp. 2nd Deb. Stock ...	Stock	...	...	...	101 —104	101 —104	...	...
30,000	Callender's Cable Construction shares, Nos. 1—30,000 ...	5	15 %	15 %	15 %	14 — 15	14 —15	14⅜	...
40,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5½ — 6	5½ — 6	5 9/16	5 5/16
90,000*l*	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	Stock	...	...	...	109 —113	109 —113	...	...
206,297	Central London Railway, Ord. Shares	10	...	...	...	9¼ — 9⅜	9¼ — 9⅜	9⅜	9⅜
78,703	Do. do. Pref. half-shares	5	...	...	...	4¼ — 5	4⅜ — 5¼	5	...
78,703	Do. do. Def. do.	5	...	...	...	4⅜ — 5¼	4⅜ — 5¼	...	...
855,000	City and South London Railway	Stock	2⅛%	1⅞%	1½%	55 — 57	55 — 57	...	...
37,500	Do. do. Ord. shares Nos. 22,501 to 60,000	10	...	...	...	5¼ — 5⅜	5¼ — 5⅜	5½	...
54,000	Crompton & Co., Nos. 1 to 54,000	3	6 %	7½%	...	3½ — 4	3½ — 4	3½	...
100,000*l*	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	...	...	...	102 —105	102 —107	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	6 %	...	1 — 1½	1 — 1½	1¼	1⅛
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 %	6 %	...	2 — 3	2 — 3	...	...
344,023*l*	Do. do. do. 4 % Deb. Stock Red ...	100	...	...	...	87 — 89	87 — 89	...	...
100,000*l*	Do. do. 5% 2nd Deb. Stock Prov. Certs. all pd.	100	...	...	...	94 — 98	94 — 98	...	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	...	1⅞ — 2¼	1⅞ — 2¼	...	...
25,000	Do. do. 7 % Cum. Pref., 1 to 25,000... ...	2	7 %	...	...	2½ — 3	2½ — 3	...	...
182,500*l*	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	101 —104	100 —103	...	...
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	14 %	15 %	20 %	15½ — 16½	15½ — 16½	16¼	...
35,000	Do. do. do. 4½ % Pref.	5	...	4½%	4½%	5½ — 6	5½ — 6	...	...
50,000*l*	Do. do. do. 4½ Mort. Deb. Stock...	Stock	...	...	...	107 —111	107 —111	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	...	21 — 22	21 — 22	21 7/16	21⅜
300,000*l*	Do. do. do. 4 % 1st Mort. Deb	100	...	...	...	101 —104	101 —104	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	3¼%	3⅜%	3¼%	8 — 8½	8⅛ — 8¼	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5	...	12½ — 13½	13 — 13¼	...	...
	§Rosling, Appleby & Fynn 6 % Cum. Pref.	£1	...	...	6 %	... — ...	19/- to 20/-	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	36 — 40	36 — 40	39	...
150,000*l*	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	...	...	...	102 —105	102 —105	...	...
20,000	Telegraph Manufacturing, Ord. Nos. 1 to 20,000	5	8 %	12 %	12 %	10 — 11	10 — 11	10¾	...
20,000	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000...	5	...	...	...	5½ — 6	5½ — 6	6	...
540,000*l*	Waterloo and City Railway, Ord. Stock	100	3 %	3 %	3 %	93 — 96	93 — 96	...	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § From Bradford Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, 1/16—1/8
National Electric Free Wiring, 12/6 paid, 1/16—1/8.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 15½—16½.
Do. do. Pref. (£10 pd.), 10—11.
*T. Parker, £10 (fully paid), 16½.

* From Birmingham Share List.

Bank rate of discount 3½ per cent. (June 6th, 1901).

MARKET QUOTATIONS, Wednesday, June 26th.

CHEMICALS, &c.		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	5/-	..
a ,, Nitric	per cwt.	22/-	22/-	..
a ,, Oxalic	per cwt.	32/-	32/-	..
a ,, Sulphuric	per cwt.	5/6	5/6	..
a Ammoniac, Sal	per cwt.	30/-	30/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	£33 10	..
a ,, ,, ..	per ton	£30	£30	..
a Bleaching powder	per ton	£7	£7	..
a Bisulphide of Carbon	per ton	£15	£15	..
a Borax	per ton	£15	£15	..
a Bensole (90 %)	per gal.	7/-	7/-	..
a ,, (50/90%)	per gal.	5/6	5/6	..
a Copper Sulphate	per ton	£23	£23	..
a Lead, Nitrate	per ton	£24	£24	..
a ,, White Sugar	per ton	£31	£31	..
a ,, Peroxide	per ton	£27 10	£27 10	..
a Methylated Spirit	per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160° C).	per gal.	5/6	5/6	..
a Potash, Bichromate, in casks..	per lb.	8½d.	8½d.	..
a ,, Caustic (75/80%) ..	per ton	£24	£24	..
a ,, Bisulphate	per ton	£35	£35	..
a Shellac	per cwt.	61/-	61/-	..
a Sulphate of Magnesia	per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6	£6	..
a ,, Recovered	per ton	£5 10	£5 10	..
a ,, Lump	per ton	£5	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	£10 15	..
a ,, Crystals	per ton	£8	£8	..
,, Bichromate, casks ..	per lb.	2¾d.	2¾d.	..

METALS, &c.				
b Aluminium Wire, in ton lots..	per ton	£224	£224	..
b ,, Sheet, in ton lots	per ton	£191	£191	..
p Babbitt's metal ingots.. ..	per ton	£75 to £140	£75 to £140	..
Brass (rolled metal 2" to 12") basis	per lb.	7⅞d.	7½d.	⅛d. inc.
Tube (brazed)	per lb.	10d.	10d.	..
c ,, ,, (solid drawn) ..	per lb.	8¼d.	8¼d.	..
c ,, Wire, basis	per lb.	8d.	8d.	..
c Copper Tubes (brazed) ..	per lb.	11d.	11d.	..
c ,, ,, (solid drawn) ..	per lb.	10¾d.	10¾d.	..
g Copper Bars (best selected) ..	per ton	£85	£85	..

METALS, &c. *(continued.)*		This week.	Last week.	Inc. or Dec.
g Copper Sheet	per ton	£85	£85	..
g ,, Rod	per ton	£85	£85	..
c ,, (Electrolytic) Bars ..	per ton	£82	£82	..
c ,, ,, Sheets ..	per ton	£90	£90	..
c ,, ,, Rod ..	per ton	£84	£84	..
c ,, ,, H.C. Wire	per lb.	9¾d.	9¾d.	..
f Ebonite Rod	per lb.	8/-	8/-	..
f ,, Sheet	per lb.	5/-	5/-	..
n German Silver Wire	per lb.	1/5	1/5	..
h Gutta-percha fine	per lb.	8/-	8/-	..
h India-rubber, Para fine	per lb.	3/9	3/8½	½d. inc.
i Iron, Charcoal Sheets	per ton	£18	£18	..
i ,, Pig (Cleveland warrants) ..	per ton	44/2	44/10½	8½d. dec.
i ,, Forgings, according to size	per ton	From £11	From £11	..
i ,, Scrap, heavy	per ton	70/- to 72/6	70/- to 72/6	..
i ,, Wire, galvanised No. 8 ..	per ton	£10 5	£10 5	..
g Lead, English Ingot	per ton	£12 12 6 to £12 15 6	£12 12 6 to £12 15	..
g ,, ,, Sheet	per ton	£13 10	£13 10	..
m Manganin Wire No. 28	per lb.	8/-	8/-	..
g Mercury	per bot.	£9 2 6	£9 2 6	..
d Mica (in original cases), small ..	per lb.	3d. to 9d.	3d. to 9d.	..
d ,, ,, ,, medium	per lb.	1/9 to 2/9	1/9 to 2/9	..
d ,, ,, ,, large ..	per lb.	3/3 to 7/3	3/3 to 7/3	..
p Phosphor Bronze, plain castings	per lb.	1/0½ to 1/3	1/0½ to 1/3	..
p ,, rolled bars & rods	per lb.	1/1 to 1/4	1/1 to 1/4	..
p ,, ,, strip & sheet	per lb.	From 1/3	From 1/3	..
o Platinum	per oz.	£4 1	£4 1	..
p Silicium Bronze Wire	per lb.	10½d. to 1/0½	10½d. to 1/0½	..
i Steel, Magnet, acc'd'ng to desc'p'n	per ton	From £15 to £40		..
i ,, ,, in bars		£58	£58	..
g Tin, block	per ton	£131 10 to £132	£131 10 to £132 10	10/- dec.
g ,, foil	per lb.	1/6	1/6	..
n ,, wire, Nos. 1 to 16	per lb.	1/9	1/9	..
p White Anti-friction Metals — "White Ant" brand	per ton	£35 to £65	£35 to £65	..
j Yarns, Cotton, Single 10 lb. b'ndl's	per lb.	8½d.	8½d.	..
j ,, Best Flax, 6 lea.	per lb.	6d.	6d.	..
j ,, Hemp, 3 ply 10 lbs. ..	per lb.	4½d.	4½d.	..
j ,, ,, Russian, 10 lbs. ..	per lb.	5½d.	5½d.	..
j ,, Jute, 180 lbs. rove ..	per ton	£14 5	£14 5	..
k Zinc, Sh't. (Vielle Montagne bnd.)	per ton	£22 10	£22 10	..

Quotations supplied by { a Messrs. G. Boor & Co. b The British Aluminium Co., Ltd. c Messrs. Thos. Bolton & Sons. d Messrs. F. Wiggins & Sons. e Messrs. Frederick Smith & Co.

Quotations supplied by { f India-Rubber, G.-P. and Teleg. Works g Messrs. James & Shakespeare, [Co., Ltd. h Messrs. Jackson & Till. i Messrs. Bolling & Lowe. j Messrs. Henry C. Yeo & Co.

Quotations supplied by { k Messrs. Morris Ashby, Limited m Messrs. W. T. Glover & Co., Ltd. n Messrs. P. Ormiston & Sons. o Messrs. Johnson, Matthey & Co., Ltd. p The Phosphor Bronze Company Ltd.

INSTITUTION OF ELECTRICAL ENGINEERS.

STORAGE BATTERIES IN ELECTRIC POWER STATIONS CONTROLLED BY REVERSIBLE BOOSTERS.

By J. S. Highfield, Member.

(*Paper read May 9th*, 1901.)

(*Continued from page* 1081.)

This booster is used in series with the battery at all times when the plant is running, or when regulation is necessary when the battery alone is driving the load. The curves, figs. 11, 12, 13 show the results obtained. The curves shown are for a Friday and Saturday load, and hence indicate the working when the variations of the load are most violent. The curves have been plotted from readings taken on Elliott's Weston instruments, one observer reading each instrument. After operating the line from 11 p.m. on Thursday night, the night load consisting of late cars up to 1 a.m., and about 50 h.p. of motors at a colliery, and the early cars from 4.30 a.m. to 6.30 a.m. on Friday morning, a 125-kw. shunt-wound unit was connected, and run at full load till 2 p.m., the battery during the time from 6.30 to 8 a.m. gaining a certain amount of charge; from 2 p.m. a 215-kw. shunt-wound unit took the load running with from 300 to 350 amperes, the battery gaining in charge till shutting down at 11 p.m., when it ended fully charged The figures relating to the day's work are as follows:—

Units generated amounted to			2,119
„ to line	„	„	2,045
Battery charge	„	„	272
„ discharge	„	„	318
Used by booster motor		...	66
Maximum load on line		...	382 kw.
Minimum „	„	...	20 kw.

There is some difficulty in accurately metering the battery units, owing to the violent changes in the strength and direction of the current. The above figures were obtained from two Thomson-Houston watt-hour meters in series, provided with pawls to admit of revolution in one direction only. The generator units were measured on an Aron meter, and the booster and line units on Hookham meters.

From March 2nd to March 31st the figures obtained were as follows:—

Units generated	...	65,615
„ sent to line	...	61,665
„ used by booster	...	2,034
„ charge	...	10,517
„ discharge	...	8,560

Giving the following percentages:—

Units sold. Generated. Per cent.	Booster. Generated. Per cent.	Charge. Generated. Per cent.	Discharge. Sold. Per cent.	Discharge. Charge. Per cent.
94	3·1	16	13·9	81·4

The difference between units generated and units metered to line is, of course, due to the units used by the booster motor and the units lost in the battery; the figures, it will be noted, check one another very closely; the former figure is 3,950 units, and the latter 3,991 units. The slight discrepancy is accounted for by the fact that the units metered to the line are read on an ampere-hour meter, and an error in the line pressure would affect the figure. All the other readings are taken on watt-hour meters. The battery efficiency is really rather higher than 81·4 per cent. At the beginning of the month the average specific gravity was 1·205 when the cells were fully charged. At the end of the month the specific gravity had risen to 1·210, showing that more charging was given than would have been necessary if sufficient charge had been given during the previous month. The small percentage of energy taken by the booster motor is confirmed over a long period, as shown by the additional figures in the appendix. The percentage of the whole number of units generated which passed through the battery is also rather surprising, considering that the battery takes more than one-half of the maximum line load. Referring to the appendix figures, I should say that the booster described in the paper was put to work

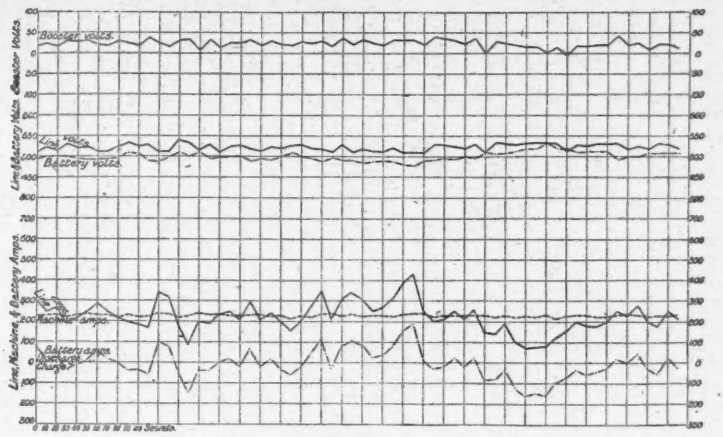


Fig. 11.—Curves showing Load on Generator, Line and Battery operating Traction Load with Reversible Booster.

Generator—125 kw. shunt wound.
Battery—240 cells, 450 amperes per hour.
Booster—25 kw. capacity.
Cars on Line—One with 2·25 h.p. motors for 52 passengers.
„ „ 19 with 2·35 h.p. motors for 79 passengers.
(Readings taken Friday, March 1st, 1901, morning.)

Fig. 12.—Curves Showing Load on Generator, Line, and Battery, operating Traction Load with Reversible Booster.

Generator—210 kw. shunt wound.
Battery—240 cells, 450 amperes per hour.
Booster—25 kw. capacity.
Cars on line—Two with 2·25-h.p. motors for 52 passengers.
„ „ 23 with 2·35-h.p. motors for 79 passengers.
(Readings taken Saturday, March 22nd, 1901, afternoon.)

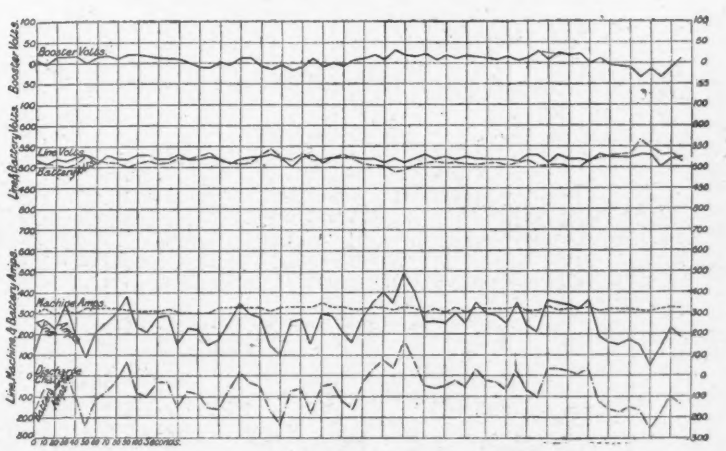


Fig 13.—Curves Showing Load on Generator, Line, and Battery, operating Traction Load with Reversible Booster,

Generator—210 kw. shunt-wound.
Battery—240 cells, 450 amperes per hour.
Booster—25 kw. capacity.
Cars on line—One with 2·25-h.p. motors for 52 passengers.
„ „ 21 with 2·35-h.p. motors for 79 passengers.
(Readings taken Friday, March 1st, 1901, afternoon.)

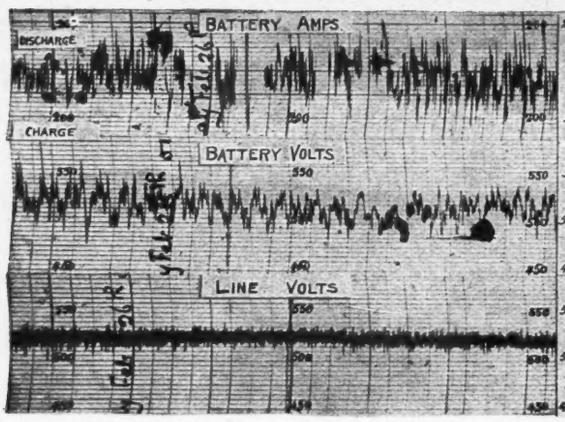


FIG. 15.—WORKING WITH BOOSTER.

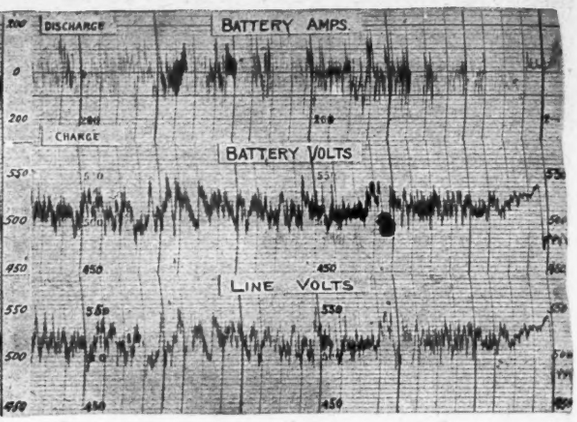


FIG. 14.—WORKING WITHOUT BOOSTER.

Recorder Curves for Traction Load worked with Battery and Reversible Booster.

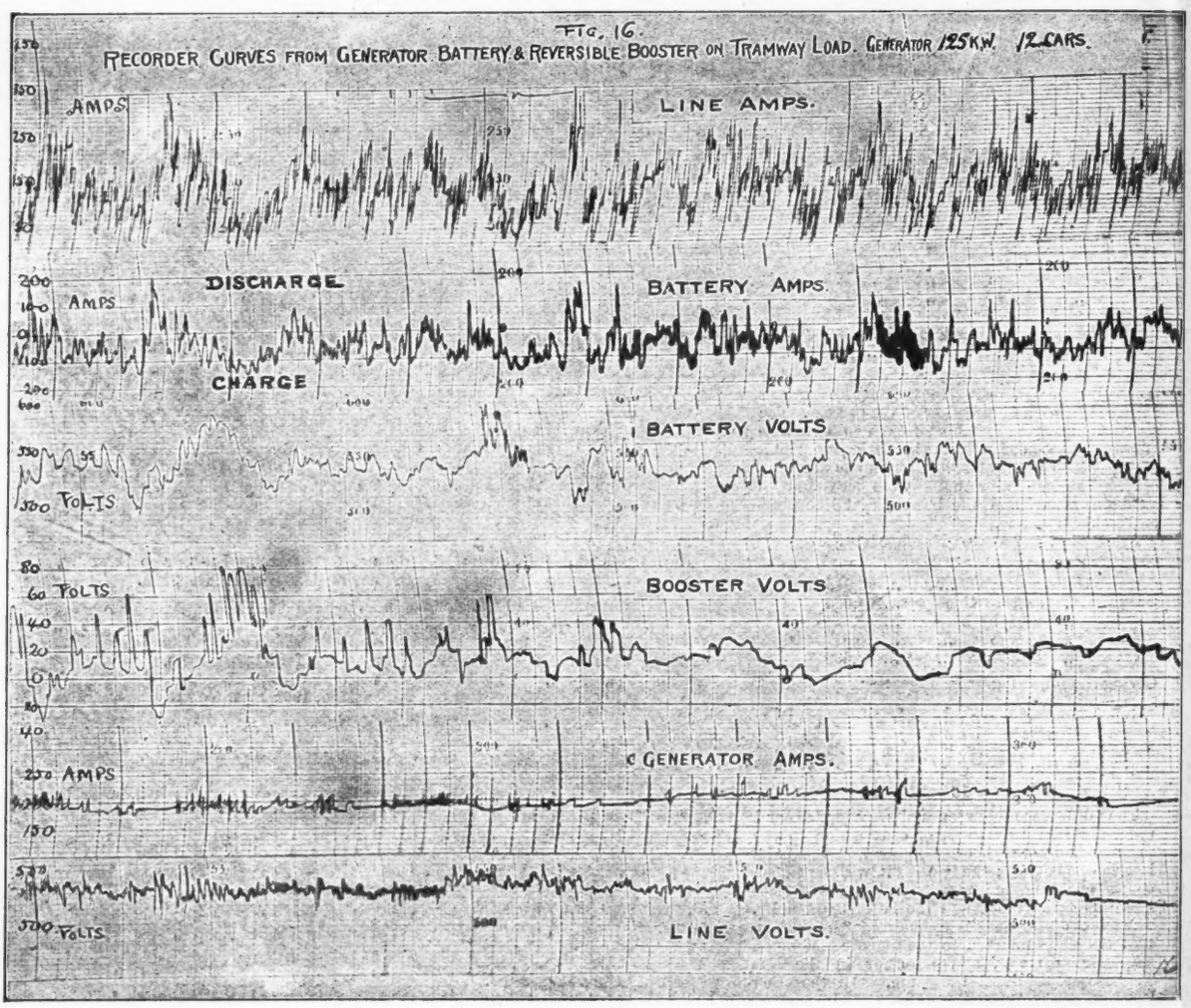


FIG. 16.—RECORDER CURVES FROM GENERATOR BATTERY AND REVERSIBLE BOOSTER ON TRAMWAY LOAD.
Generator 125 KW. 12 cars.

in the middle of August. Before that time a small booster of the same type was used with a battery giving 100 amperes at the one-hour rate. This battery frequently gave discharges of 170 amperes. This was the first booster made of the type described, and was of an experimental nature. Unfortunately, I had not arranged for the metering of all the units at that time, and, therefore, no figures relating to its operation are available.

Figs. 14, 15, 16, 17 show curves photographically reproduced from charts taken from Elliott recording instruments. Fig. 14 shows the action of the battery without the reversible booster, the line pressure being kept by hand from 490 to 550 volts. Without hand regulation, the variation on a shunt-wound generator would be altogether too great if the battery were worked anywhere near the one-hour rate. Figs. 15, 16, 17 show the operation with the booster in the ordinary way of working. Unfortunately, the instrument on the generator was not of the latest type, fitted with a dash-pot, so that the quick changes which occur are somewhat magnified. Errors in the engine governor also account for some variations.

I should here note that the ultimate object of the booster is to correct for the varying characteristic of the battery: when in a partly charged condition, the battery characteristic is a falling one, somewhat similar to the characteristic of a shunt-wound generator. The characteristic, however, varies according to the

state of charge of the battery. The reversible booster described serves to correct for the varying nature of the battery characteristic so as to make the characteristic of the battery and booster the same whatever the state of charge, and to make it either falling or flat, or rising over a wide range. By making the characteristic flat, the load on a shunt-wound generator working in parallel with the boosted battery will be nearly constant. By adjusting the booster so that the characteristic closely follows the characteristic of the generator, whether shunt or compound wound, the load will be shared by the battery as in the case of two generators in parallel.

improvement in economy can be attained by a further levelling of the load by a battery. There may be special cases, for instance, where a small all-night service is worked, or where a peak, due to extra cars, exists at stated hours, which a battery could carry, and so save the use of extra boilers or engines for only one or two hours. In general, however, I am inclined to consider that the central station is not the correct place for a battery to be used with plant for this size of road. Consider the case where a system of town tramways, operating upwards of 400 cars, is driven from a single station situated reasonably near to the centre of the load, several of

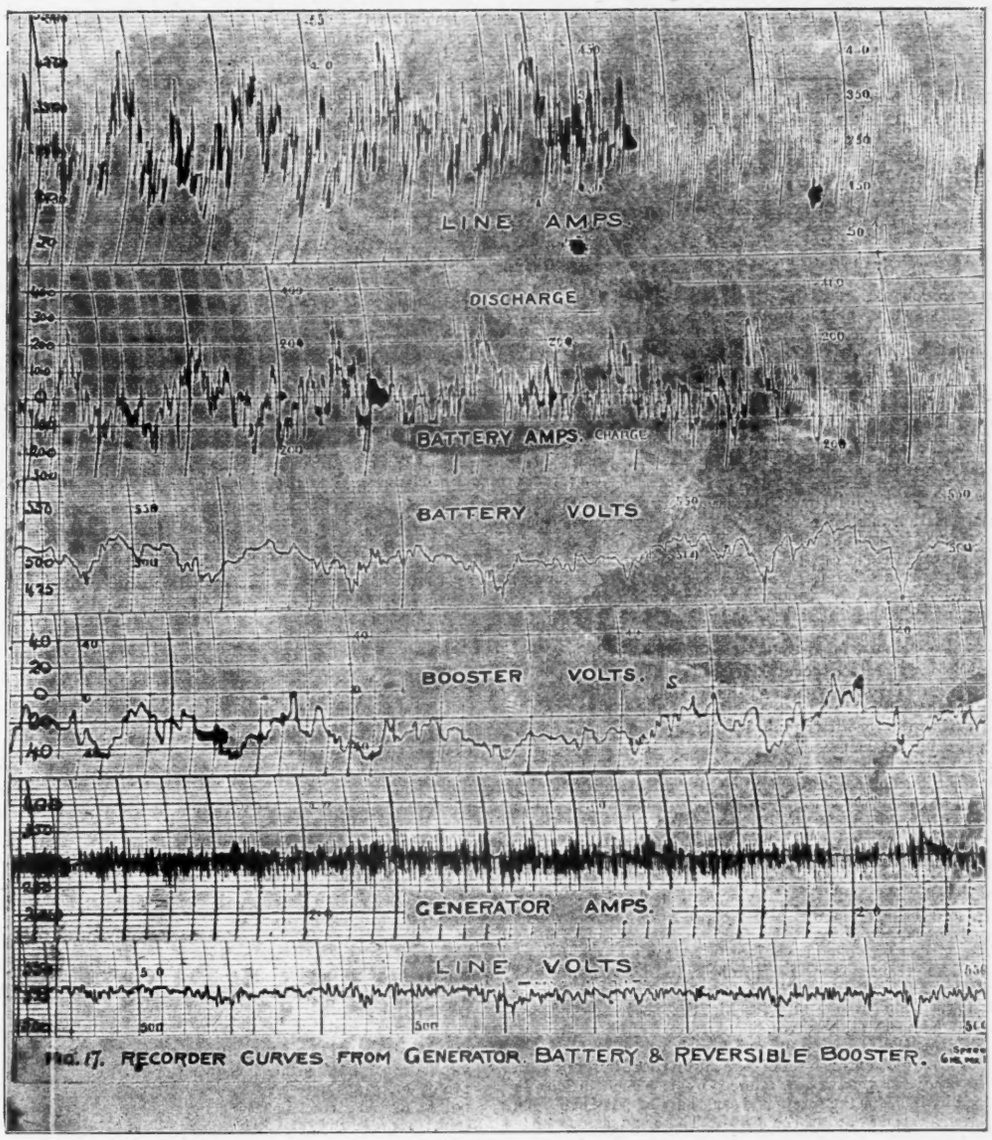


Fig. 17.—Recorder Curves from Generator Battery and Reversible Booster.

There is one other point I should here refer to, that is the nature of the fluctuations of the current taken by the motor driving the booster. Since the number of cells used is 240, the boost on the top charge amounts to 100 volts, that is, the pressure is from 600 to 620 volts on the cells when they are fully charged. The least pressure to which the battery falls on the heaviest discharges is 440 volts, the boost on charge is therefore greater than on discharge, hence with the same current the motor takes more driving on charge than on discharge; and therefore, with the steady load on the generator, the charging current is never as great as the discharging current, as will be seen from the curves. The greatest observed current taken by the motor is 70 amperes, but this is unusual, the normal maximum not exceeding 50, or about 7 per cent. of the maximum load.

The battery used consists of 240 cells, giving 450 amperes at a one-hour rate of discharge. The booster is rated for 200 amperes continuously, and will carry 450 amperes momentarily; the brushes work without lead, and do not spark even when a current of 200 amperes is passing without any field.

In considering the use of batteries in connection with large plant operating roads with upwards of 400 cars, it is necessary to take into account the above-mentioned fact, that the load will be a fairly even one, and with properly designed engines very little

the routes running out some six or more miles in various directions from the centre. Each route should be fed by its own feeders to obviate any breakdown on one route affecting the remainder; each route might account for 30 or 40 cars, the load on each set of feeders would be of the same character as the load on a small system with a load-factor of not more than 25 per cent. There is no doubt, therefore, that given suitable sites, batteries in sub-stations worked as described above would serve to keep the load on the feeders constant, and since less than a third of the maximum current would be carried by the rails, the use of boosted rail-feeders would be obviated.

The same arguments also apply to the case where the power-station is so far outside the area as to necessitate the use of converted high-tension currents: by using a suitable battery in the sub-stations the load on the converters could be kept constant, the rotaries would then operate more perfectly: they need not be of such great capacity as without batteries, and the high-tension feeders could be designed to carry the mean current instead of the maximum.

A power station supplying energy to a railway, as distinguished from a tramway, will, in general, carry a load of the same character as that of a small tramway plant; but the fluctuations of the load will be of greater amount due to the greater energy taken in starting

the heavier vehicles. At the same time, it is more easy to arrange the running schedule for a railway than for a street tramway, so that only a few cars or trains start or ascend heavy grades simultaneously; the stops generally are less frequent, and the road is flatter than that obtaining in the ordinary tramway. The distances run will probably, however, be greater, and therefore the right place for batteries on a railway system will be in sub-stations situated near the load centres.

(To be continued.)

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

Presidential Address delivered by MR. W. A. CHAMEN, at Glasgow, June 19th, 1901.

I HAVE to congratulate you upon the incorporation of this Association. We are starting into a new century and into a new reign as a newly incorporated body. Drawing up the memorandum and articles of association has been a work of great labour and has extended over some considerable time. Our honorary solicitor, Mr. Alderman Pearson, has carried the whole matter through for us in a most admirable manner, and we owe him for his toil and patience a great debt of gratitude which we shall find it hard to repay by anything we are able to do in return.

On looking over the addresses of the last two Presidents I find that the affairs of the Municipal Electrical Association and its work have been so fully and so ably dealt with, and that so many of the points indicated as requiring attention and providing work for the Association still occupy those same prominent positions, that I would ask those of you who were not present at the last two conventions to obtain copies of the *Proceedings* for the last two years from the secretary, if you have not already done so, and to read over those two addresses. I do not propose in this short address to draw your attention to the brief but important history of the Municipal Electrical Association and to its rapid progress, as was so very clearly done by your much respected Past-President, Mr. Mountain, to whom so great a measure of the success of this Association is due, owing to the unflagging energy he displayed from the start as your first honorary secretary. I have, however, to congratulate you on the further large increase of membership from 77 committee members at last convention to 98, and from 142 engineer members of all classes to 165 at the present time, our present total membership being thus 264, or an addition of 55 since the last convention. This increase must be considered most satisfactory, and I think there are indications of a still further considerable increase during the coming year. I regret that we have to record the loss by death of one member, Mr. A. H. Roe, of Bury St. Edmunds.

We have suffered some losses through members resigning their positions as corporation engineers to take up posts with companies or to practice as consulting engineers on their own account. More especially have we to lament in this way the loss of Mr. C. H. Wordingham, who was president, I believe, during the second year of our existence, and who was one of the founders of this Association. This is indeed a great loss to us, for the energy and ability which he brought into our meetings was of a kind not easily replaced. Mr. Wordingham was also treasurer of the Benevolent Fund, which owes its existence, I think, almost entirely to his efforts. Though not now one of us, I am glad to tell you that he continues to take great interest in our doings, and he has promised that he will, whenever possible, attend our conventions and join in our discussions. I am sure we all wish him that success in his new departure which he so well deserves.

I have to draw the attention of our Associates to the fact that there has not been that enthusiasm displayed by them in sending in papers competing for the prizes offered by the Association, in consequence of which for the present year the Council have been obliged to suspend the award of the prize. This is a matter which, I trust, will receive your attention and be discussed at the business meeting on Friday evening.

You will have observed from the programme that there are fewer papers to be read and discussed at this meeting than there were at last year's convention. I believe you will all agree with the Council in thinking that it is better to have fewer subjects before us, and longer time for discussing them, and also that it is more satisfactory for the papers to be read to the meeting by their respective authors than to be held as read and discussed forthwith. The Council feel that we are likely to get far more useful discussions in this way, as all present will at least understand what it is that is being discussed.

As already indicated, I do not propose in this short address to touch upon all the subjects which appear to require, during the present year, the attention of this Association, as they have been already so clearly pointed out by your two past-presidents, Mr. Faraday Proctor and Mr. Mountain; but I ought, perhaps, to emphasise one of them, viz., the suspension of payments to sinking fund during course of construction and for two or three years afterwards. Many municipal electrical undertakings are feeling the burden, and I may say the unfairness, of being taxed during the first few years of their existence, while they are in a state either wholly or partially unproductive of revenue by being compelled to pay from the start their annual contribution to the sinking fund. While it is, of course, necessary that Parliament should take steps to ensure the paying off of the debt in a proper time, it does seem that it is rather unreasonable to enforce this annual payment from the very start of the undertaking, when it must be so obvious that the concern has had no time or opportunity to bring in a revenue at all proportional to the capital which has been expended upon it. This question is now actively engaging the attention of the Council, and I do not know that I need to say more about it here, except to point out that it also arises in extensions of existing undertakings into new areas not previously supplied, and which require not only new mains but new generating stations, and, in fact, a new start and new loans for that specific purpose.

There is, however, one point which has not been touched upon by your two Past-Presidents, but which I should like specially to bring before your notice. I refer to the question of "System Charging for Electricity."

Doubtless this is a dry and uninteresting subject, and many of you will think that I might have chosen some engineering point arising out of the experience gained in carrying out the large new electricity works which have been now nearly completed in this city, or in carrying on the supply from these works. Well, gentlemen, that after all is what I have done. We engineers naturally love our machinery, our mains and our whole plant, but we soon find that our attention gets drawn also to other things, and chiefly to that all important question of money. It is of no use to leave this question to the purely commercial people. If we do so they soon come to us and say, "How is it that you are always asking for more machinery, and thus wanting to increase the capital expenditure? Why won't you get more units out of the plant you have already installed? The undertaking grows, it is true, but if you go on at this rate, we shall never get the price down. What is the meaning of it?" You all know the answer. The poor engineer has to say: "Well, every winter the maximum load goes on increasing, and we must have the plant if we are to meet the maximum demand that will be made upon us next December." If the engineer leaves the matter at that, the commercial man goes off grumbling, and saying that "he supposes it can't be helped, and that the electric lighting is a poor business," and so the matter ends for the time being.

Many of my colleagues in this Association have, however, not been content to leave this question undealt with, and have set to work to explain that it is only for about three or four months in the year that the machinery is all at work, and then only for a few hours each day at anything like full load, so that the only way in which more units can be got out of the plant is by finding some demand which shall make longer use of it. The commercial people see this, and try systems of discounts in order to encourage large consumers, but still the trouble remains, and the engineer gets disliked for pointing out a difficulty and suggesting no remedy. The whole business, therefore, settles comfortably down on his shoulders, and he has in the end to suggest some remedy.

The question of price at first sight seems a very simple matter; total up the cost of coal, wages, repairs, and petty store bills for the year, and add all the capital charges (*i.e.*, interest and sinking-fund) and the management expenses; divide this sum by the number of units sold, and the result is the *cost* per unit. Add to this whatever margin is deemed necessary, and the result is the price per unit. Such a method of arriving at the selling price of electricity possesses one advantage—viz, that it is simple. That, however, seems to be all that can be said for it.

It is known to everyone that as a rule the greater the quantity of any commodity that can be sold, the lower will be the cost of producing it, but the real reason why this is so is understood by comparatively few. There is, for instance, the well-known tale of the old woman who said that she made a loss on every article she sold, and that it was only the quantity of business she did which enabled her to get her living. As she is not commonly reported to have become bankrupt, it is presumed that she had grasped the principle correctly, but was not able to understand the exact way in which it worked, or, at any rate, to properly express it in words. Doubtless, she would have lost heavily if she had not been able to sell the quantity she spoke of, and for a sale of half that quantity she might have required to increase the price in order to make any profit, or, indeed, to avoid making any loss; so that up to that point she was correct in saying she made a loss on every article she sold. I do not think this old woman ever sold electricity, but I have no doubt that if that problem had been thrust upon her, she would have displayed the same sagacity, and would have adapted herself to the altered circumstances. She might have been a most useful member of an electricity committee.

We may here note a few facts before proceeding. I quote figures from the electricity department of Glasgow as being the readiest at hand. The number of units of electricity sold during the year just concluded (May 31st) was, roughly, 6½ millions. The maximum load occurred during November, December and January at 5 o'clock on each night except Saturdays and Sundays. The plant used (allowing ample spares and stand-bys), if continuously in use at full load, would have produced some 81 million units in the year, and this extra 74½ million units could have been sold probably at a profit to the existing consumers if they could have taken it for the low price of about ½d. per unit without any additional capital expenditure or increased management expenses of any kind. Of course, I do not suggest that we could ever hope to sell such a quantity as this, but there is a long stretch between 6½ millions and 81 millions, and we might sell more than we do. Let us look a little more closely, though briefly, into some of the figures. The cost of buildings, plant (including spare) and mains runs out at present at about £114 per kilowatt. This figure, of course, varies from time to time, and will go down again when fair proportions become established between the cost of sites, buildings, machinery and mains, perhaps to £80 or less. It is already down to about £104. This, however, does not affect us just now.

The standing charges, being interest, sinking fund, wages, rents,

rates and taxes, management expenses, and repairs amount together to, say, £8 3s. per kilowatt per annum. This figure is arrived at by taking out the individual maximum demands of the consumers and dividing the total standing charges by the sum of them. You will note that the sum of the consumers' maximum demands is greater than the actual maximum demand upon the generating plant by about 25 per cent., which we may take to mean, roughly speaking, that some 25 per cent. of the consumers either do not come on at all, or, at least, not to their full extent, until after the time of maximum demand upon the generating stations is past. You will note, therefore, that in apportioning the standing charges per kilowatt due allowance is made for this fact, and the standing charges are less than they would be by about 25 per cent. on account of this diversity factor. This shows the advantage which consumers get by taking the supply from a common source. Let us now consider a few different classes of consumers, and see how they use their light, taking, in each case, their maximum demand, for the sake of argument, as 1 KW., and finding out what number of hours' use per day the quantity of units they each consume is equivalent to, spreading our investigations, of course, over the whole year. We find the following:—

Street lighting (all night),	10½	hours per day,	3,832	units per ann.	
Public house	5	„ „	1,825	„	„
Restaurant	4	„ „	1,460	„	„
Domestic consumer say	3	„ „	1,095	„	„
Theatre	2	„ „	730	„	„
Office	1	„ „	365	„	„
Total			9,307	„	„

These figures are simply examples, being easy to follow, but they are not quite accurate. For instance, many of the offices average less than half an hour, while domestic consumers average only about 2½ hours; but we need not worry about fractions for our present purpose. Suppose we had a small concern with these six different consumers as partners; the maximum demand of each is the same, viz., 1 KW., and the standing charge of £8 3s. is incurred by each, quite irrespective of the amount of electricity consumed, and we have already seen that by combining together, this standing charge is reduced below what it would be if each had his own plant, owing to the fact that the theatre does not want light when the office does, and

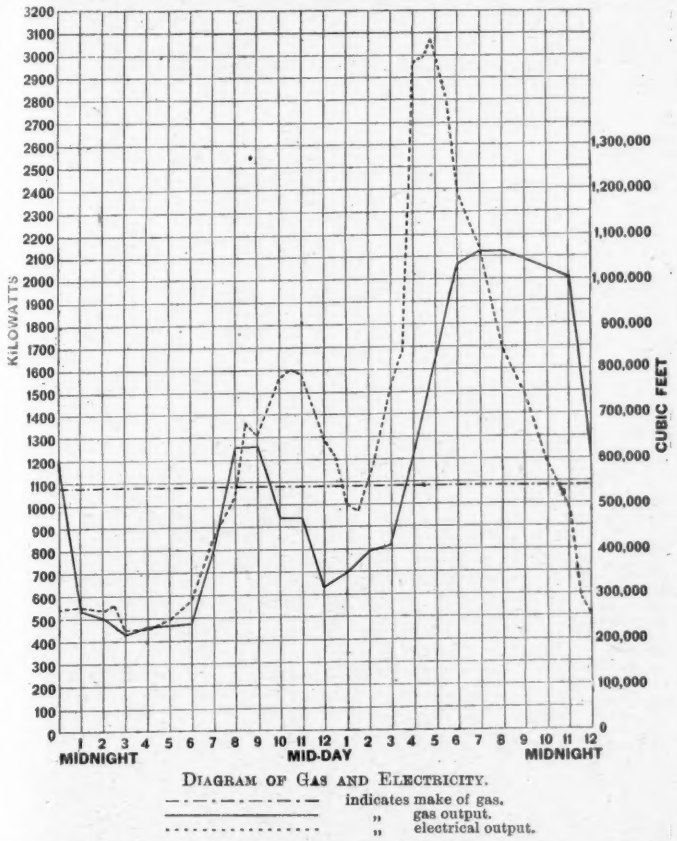


DIAGRAM OF GAS AND ELECTRICITY.
indicates make of gas.
„ gas output.
„ electrical output.

that the domestic consumer also does not fully light up when the others are at their maximum. It seems to me, therefore, that these partners as ordinary business men would each agree to pay £8 3s. per annum in a lump sum plus the working costs according to the number of units consumed in each case.

Let us look, however, at the question of coal. I am obliged to put before you some figures obtained some time ago, which while they certainly would be somewhat less at the present time, will serve for our present purpose. The cost of coal per unit for the various different classes of consumers is greater for the short-hour ones than for the long-hour ones, owing to the waste which occurs in getting up steam for such short runs, and in running plant at light loads. From careful tests which have been made, I believe that the following would be about the proportions of the cost of coal for the different consumers:—

Street lighting	·51d. per unit.
Public house	·51d. „
Restaurant	·62d. „
Domestic consumer	·69d. „
Theatre	·77d. „
Office	·84d. „

These costs include carting and handling of the coal and removal of the ashes, &c. The street lighting should really be a lower figure, but no information was at hand at the time the figures were obtained, so that it was put in the same as for a five-hour consumer. In passing, I may say that during the past six months one-third of the coal we have consumed has been wasted practically through intermittent and varying loads. If we now make up the accounts for these six consumers, we find they come out as follows:—

Class.	Hours.	No. of units used by each class.	Standing charge.	Total coal bills.	Total charge.	Average per unit.	Level rate of 1·84d. Total bills.
			£ s. d.	£ s. d.	£ s. d.	d.	£ s. d.
Street lighting ..	10½	3,832	8 3 0	8 1 10	16 4 10	1·02	29 6 10
Public house ..	5	1,825	8 3 0	3 17 6	12 0 6	1·57	14 0 0
Restaurant	4	1,460	8 3 0	3 12 11	11 15 11	1·94	11 4 0
Domestic consumer	3	1,095	8 3 0	3 2 11	11 5 11	2·45	8 8 0
Theatre	2	730	8 3 0	2 6 10	10 9 10	3·42	5 12 0
Office..	1	365	8 3 0	1 5 6	9 8 6	6·14	2 16 0
	—	9,307	48 18 0	23 7 6	71 5 6	—	71 6 10

It may be objected that I have not taken into account water, oil, &c., but these are small, and will make no material difference to the result.

You will observe that the street-lighting consumer pays an average price of 1·02 pence per unit, and the office an average price of 6·14 pence per unit, and that the other consumers vary between these two extremes. It seems to me that for lighting purposes this method of looking at the matter is a fair and just one. An electrical engineer of long experience made the following remark in discussing this troublesome question with me some few months ago. "There are," he said, "two principles upon which consumers can be charged. One is that of dividing the total costs for the year by the number of units sold. That is to say, to charge an average price (which works out at about 4d. per unit). The other is that of approximating the charge to each consumer to the cost of supplying him." I think that expresses our position exactly, but which of these principles are we to work upon? I have shown you in a rough and ready manner, without any pretence, of course, to a close degree of accuracy, how the costs per unit must vary between very wide limits, and this mostly on account of the very short use which is made of the plant by many of the consumers. If you take out the average cost per unit from the table I have given you it will come to only 1·84d. per unit. If you charge this uniform price, however, you will be charging the street lighting with over £29 instead of £16, and the office will be let off with £6 14s. instead of paying £9 8s. 6d., and you must remember that in actual fact the proportions of these different classes of consumers are by no means what are given you in this table. Which of us can show one-sixth of our maximum demand occupied in street lighting and another two-sixths in five-hour and four-hour consumers? If you take my table and adapt it to your own circumstances, I do not think any of you will be able to work out an average of 1·84d. per unit.

By using a sliding scale of charge in Glasgow the cost of producing our 6½ million units in the year just concluded works out at about 3·18d. per unit, or perhaps less, and we have estimated on selling 9,000,000 units for next year at an average cost of production of 2·61d. per unit. The charges are 6d. for the first 365 hours' use per annum of the maximum demand and 1d. thereafter, with, however, uniform rates of 3½d. for domestic consumers, theatres and halls, 3d. for churches, and 1½d. for power. Many of our consumers, however, will be paying only about 2d. per unit for lighting under the sliding scale. Do you think we should be able to keep them at 3½d., or perhaps 4d., or do you think we should go on increasing our output at the rate of 50 per cent. per annum, as we have done for the last two years, if we reverted to a uniform rate? I am afraid we should not.

Power supply seems to me to be a different question, not simply because it is a day load, and in use, perhaps, more in summer than in winter, but because there is no natural law which forces it to come on at a maximum far in excess of its normal at any particular time of the day, a feature which is so very strongly marked in the case of lighting. The diagram shows in dotted lines the total load curve which includes both electric lighting and power on a day in last December, and you will observe how sharp a peak occurs about 5 o'clock. What is the reason of this? It is probably that the very short office load and the early closing shop load are both just on in addition to everything else. Business men are in

signing their letters, and clerks are all hard at work finishing off with the greatest possible haste, lest they should be guilty of any unpunctuality in getting away at the usual time. At this time probably every light in these offices is in use, though only for a very short time, for shortly after six o'clock the load is down again to a much lower point. In the summer, and during the greater part of the year, this does not happen. As soon as daylight draws out to five o'clock, this nightmare of a load is gone until next winter. In Glasgow we have a load of the kind to the value of about 1,540 KW., *i.e.*, we have consumers of this very short-hour class who require this amount of plant to supply them, and whose average use per day is just half an hour. They consume 248,543 units per annum, which brings in at 6d. per unit the sum of £6,208, or about 3·7 per cent. upon the capital expended to supply them. It is certain that if there were no consumers using current for longer hours than these the concern would become bankrupt in a very short time, even with a charge of 8d. per unit. I need not point out that this five o'clock peak contains practically all our consumers except churches, theatres, halls and places of amusement, and domestic consumers to some extent, as they do not light up fully as a rule until later. In fact, all but 25 per cent. are drawing a supply at this time. The conditions under which light is required cause this awkward peak, and they cannot be altered. The proportions of the peak to the whole diagram can, however, be reduced by getting on a greater number of consumers who use current longer. Power supply is a most excellent way of producing this result if we can get enough of it. In Glasgow up to date we have about 1,894 H.P. connected to our mains. It does not cease at five o'clock in the winter, and does not therefore simply fill in our load diagram in the shallow places. If it did this it might enable us to charge a uniform rate for everybody. It has no peak of its own, however. It goes on from morning to evening with the same variations, of course due to those motors which are used intermittently, but these variations average out in a reasonable way, as there is no circumstance which compels nearly the whole of the motors, whether in continuous or in intermittent use, to come on together either at five o'clock or at any other time. If we had a power load only to deal with, there would not be this peak trouble, and it would seem possible, saving only that a maxinum charge of, say, £2 per annum, should be made to cover interest on cost of meter, &c., to do all that can be wanted for all ordinary purposes by means of a scale much more nearly approaching a uniform price than the lighting one. For any purpose requiring a supply for 24 hours per day, it would seem to be unfair to make the same charge as for such intermittent use as is experienced in the case of hoists, so than an absolutely uniform rate might not be found satisfactory.

There has been an attempt to arrange a sliding scale of charging by means of meters which work on a different dial at certain hours, so that all units recorded on the second dial can be charged for at a higher price, these being the units consumed on the peak load; but up to the present no one has succeeded in producing a sufficiently cheap and satisfactory two-rate meter, so far as I am aware. Besides, if the system comes to be closely inquired into, I think it will be found that it does not fulfil the necessary requirements, and also that it is very difficult to decide as to how the arrangement should be worked during other months of the year than November, December and January, that is to say, if the maximum price is to be charged between the hours of 4 and 6 p.m. during those months, during what hours is it to be charged in the other months of the year? It does not seem to me to take a grip of the correct principle, for it would result in charging a long-hour consumer the additional price during part of the 24 hours, for the simple reason that somebody else wants to make use of the plant which is supplying him, and makes him pay extra for the other consumer's shortcomings.

I must admit that I have not had occasion to think out this system of two-rate meters fully, and I simply mention it as one that should receive consideration in dealing with this subject. It may be that there are ways of getting over these difficulties.

You are aware that the Power Bills which have been recently passed by Parliament contain clauses to the effect that for the first 400 hours' use per quarter of the maximum demand quantity the price shall not exceed 3d. per unit, and that for all further quantity the price shall not exceed 2d. per unit. This is very taking to the public eye, but where is the magic wand which enables the power companies to produce energy so wonderfully cheap, while we are unable to do so? The trick is very simple. There is no deception. The Bills contain other clauses which allow the companies to pick and choose their consumers, and to make contracts with them in a way we cannot do. Of course, the companies say they do not want to supply light, and would not on any account wish to interfere with the corporations who already do so. They obviously wish to get the supply of power, and would willingly come into any municipality, and supply it at low rates, leaving the corporations to supply light at much higher prices, which, however, might still not pay. They are willing to supply light, too, under certain conditions if asked, and, no doubt, the price would be a favourable one, but what would the conditions be? They would be found to work out so that only long-hour demands, such as street lighting or other all-night lighting, could be supplied under them.

Is it not, therefore, a question whether it is right to allow these Bills to go through in this way? Surely the fact that they are tied down in price is against the general public interest. It would have been better, it seems to me, to have allowed them a higher maximum price, and to have bound them down closer to supply on a sliding scale the general wants of the community, no matter whether for lighting or power. I would, in fact, put it to you that while, for power purposes only, the 3d. and 2d. tariff may be good enough, there should be in all these Bills a special scale for lighting, not perhaps with a maximum price per unit at all—for that may work unfairly to the company, but with a fixed charge per kilowatt per annum of, say, £8 or £9, or such other figure as may be found necessary, and 1d., or perhaps 2d., per unit for all current supplied. This is the principle first enunciated, I believe, by the late Dr. John Hopkinson. The principle of fixing a maximum price per unit, at any rate, for lighting purposes, does not seem to me to be a desirable one at all, and it introduces complications in accounts which are entirely avoided by the other method, and at the same time there is a simplicity and justice about the £8 per kilowatt of maximum demand per annum which I have always found consumers of the longer hour class to understand very readily. The fixed charge may be called a "plant rental," being, in fact, nothing but a rent for the plant which they use, and which must be kept for their use whether they want it all the year round or not. If you explain to a house factor that not paying the "plant rental," when you do not want to use the plant, is like declining to pay a proportion of your house rent for such time as you may be absent at the coast or elsewhere in the summer, he takes in the situation at once.

The question of storage might under different circumstances affect the matter to some extent, but, so far as I have been able to see, there is not much assistance to be got in that direction at present.

I am indebted to Mr. Wilson for the gas load diagram now before you. It is taken from the Dawsholm Gas Works, Glasgow, on a December day. The straight line across the sheet shows the "make" of gas. Storage in this case is an immense advantage, but we must not jump to the conclusion that storage would get us out of our difficulty as regards systems of charge. Look at the whole diagram. It is so different from ours, presumably because of the almost universal use of gas, owing to which a much better average load or load factor is obtained. It is probable, too, that our existence is of some assistance to the gas undertaking, as we have relieved it of so many of the short-hour and unprofitable consumers. It is not to be expected that our gas friends will take any great amount of pleasure in perusing our sliding scale arrangements, because by means of them we shall probably obtain more long-hour consumers, and help to relieve them of some of the profitable as well as the unprofitable ones.

I ought, before concluding, to mention the name of Mr. Arthur Wright, our first President and the inventor of the maximum demand indicator, an instrument which has been of great assistance in the arrangement of sliding scales in the most equitable manner, by enabling us to charge only upon the actual maximum demand the consumer makes, and not upon the size of his installation.

I do not know whether I have succeeded in making the reasons for a sliding scale and against a uniform rate any clearer than they were, but the matter does seem to be of such importance that I hope some of you will take it up, and perhaps read a paper at our next convention, so that we may get a good discussion upon it.

UNINSULATED RETURNS IN A TRAMWAY SYSTEM.

By JOHN H. RIDER,
Chief Electrical Engineer, London County Council Tramways.

THE general regulations prescribed by the Board of Trade, under the provisions of the Tramways Acts, include, amongst others, clauses which relate to the employment of uninsulated metallic return circuits of low resistance. Such returns, in the shape of the tramway rails, are, up to the present, in universal use in this country, and consequently the clauses mentioned are of universal application.

It is provided that the uninsulated return shall be connected with the negative terminal of the generator, and that all parts of the return circuit which do not consist of the rails shall be insulated, unless of such cross-sectional area as will reduce the difference of potential between the ends of the uninsulated return below 7 volts. This is also the maximum pressure allowed between the ends of the uninsulated return farthest from and nearest to the generating station.

Excepting, perhaps, that the maximum allowed is too high, no fault can be found with these requirements, as unless the differences of potential be kept low, excessive earth currents will flow, causing considerable damage to any metal pipes in the vicinity. The earth, being more or less a conductor, practically connects all buried metal near the track to the rails. Unless great care be taken, therefore, the return current leaks out from the rails and flows through any other metal which may be lying in the neighbourhood of the track. Being no respecter of paths, it has been even known to make use of the lead sheathing of the tramway feeders.

The mere passage of the current through these irregular paths does no harm, but at all points where the current *leaves* the rails or the pipes or the sheathing, corrosion takes place by reason of electrolytic action. The number of places at which the current flows into or out of the rails or pipes, is entirely a question of relative resistances (or of conductivities) between the various paths open to the current, and at each place of leaving, corrosion goes on. The only way to prevent leakage currents, is to make the proper path of so low a resistance, that the difference of potential between any two points is at all times exceedingly small. The requirements of the Board of Trade in this particular are most reasonable, and the engineer who thoroughly appreciates the position will endeavour to bring the maximum below this amount, for other reasons than to comply with the regulations.

In the opinion of the writer, however, some of the other regulations are not only unnecessary, but even undesirable, as for instance those relating to the earthing of the negative bus bar. Regulation No. 5 says:—"When any part of a return is uninsulated it shall be connected with the negative terminal of the generator, and in such

case the negative terminal of the generator shall also be directly connected, through the current indicator hereinafter mentioned, to two separate earth connections which shall be placed not less than 20 yards apart. Provided that in place of two such earth connections the corporation (or company) may make one connection to a main for water supply of not less than 3 in. internal diameter, &c." Regulation No. 6 says:—"When the return is partly or entirely uninsulated, the corporation (or company) shall in the construction and maintenance of the tramway (*a*) so separate the uninsulated return from the general mass of earth, and from any pipe in the vicinity; (*b*) so connect together the several lengths of the rails; (*c*) adopt such means for reducing the difference produced by the current between the potential of the uninsulated return at any one point, and the potential of the uninsulated return at any other point; and (*d*) so maintain the efficiency of the earth connections specified in the preceding regulation (No. 5) as to fulfil the following conditions, viz.:—(1) That the current passing from the earth connections through the indicator to the generator shall not at any time exceed either two amperes per mile of single tramway line, or 5 per cent. of the total current output of the station. (2) That if at any time and at any place a test be made by connecting a galvanometer or other current indicator to the uninsulated return and to any pipe in the vicinity, it shall always be possible to reverse the direction of any current indicated, by interposing a battery of three Leclanché cells connected in series if the direction of the current is from the return to the pipe, or by interposing one Leclanché cell if the direction of the current is from the pipe to the return.

"In order to provide a continuous indication that the condition (1) is complied with, the corporation (or company) shall place in a conspicuous position, a suitable, properly-connected, and correctly-marked current indicator, and shall keep it connected during the whole time the line is charged."

Condition (2) is, of course, merely intended to show that the earth connection is maintained in good order.

It will be observed that the current coming back from the rails, *viâ* the earth, to the negative bus bar, must not exceed a certain value. The strength of this earth current will depend entirely upon two things:—(1) The difference of potential between the rails and the negative bus bar; and (2) the resistance of the earth path. The former is the fall of pressure on the return feeder, which, although it may be only a small amount from the point of view of economy in transmission, may be enough to send a large current back through the earth, particularly if the resistance of the earth path be low. This may readily happen on account of the existence of water or gas pipes near the return feeder, and particularly when a water pipe is used as the earth plate at the generating station.

In the case of the Plymouth electric tramways, where the shortest return feeder is 760 yards long, being connected to the rails at their nearest point to the generating station, the resistance between the rails and the earth plate (water pipe) is only about 0·5 ohm. It was found that 25 per cent. of the return current came back through the earth.

Now the resistance of the earth path can be made practically infinite by the simple expedient of removing the earth connection from the negative bus bar.

Regulation No 6 (1) is apparently intended to protect gas and water pipes, by ensuring that no current (or only a very small amount) shall come back through the earth to the generators. Regulation No. 5 practically invites such current, and provides means for its measurement. If the earth connection be removed from the negative bus bar, no current can come back through the earth. Why, then, should the connection be made?

The Board of Trade regulations appear to provide for an earth connection at the wrong place. When the return circuit of a tramway system consists partly of uninsulated rails and partly of insulated cables, the insulated part should be kept insulated except at the point where it joins the uninsulated part, and there the earth connection should be made rather than at the other end where it is joined to the negative bus bar.

With more than one return feeder, negative boosters may be necessary, to keep the points of earth connection at the rails at about the same potential. Earth currents would then be practically non-existent. With only one return feeder no negative booster would be needed, unless it were desired to reduce the fall of pressure for economical reasons. In this case it would depend entirely upon the length of the return feeder, as to whether it would be better to add to its cross-section, or to use a negative booster. In the majority of cases the latter would probably prove the better way.

If the ventilation of this subject by the Incorporated Municipal Electrical Association should result in a modification of the Board of Trade regulations, then this short paper will not have been written in vain.

[As we announced in our last issue, the Board of Trade had anticipated Mr. Rider's points.—Eds. Elec. Rev.]

Hoylake.—The minutes of the Electric Supply Committee of the Hoylake and West Kirby U.D.C., which came up for confirmation at the monthly meeting of the Council last week, contained an entry showing that the L.G.B. would not sanction loans to defray the cost of wiring the premises of private consumers. In view of this, the Committee had considered offers from local contractors for the wiring of premises under a proposed system of deferred payments, and recommended that the offer of Messrs. Brewer & Brunt, Hoylake, should be accepted. Exception was taken to the recommendation by Mr. J. F. Smith on the grounds that it would be unduly favouring one firm, and that not more than 2 or 3 per cent. of the consumers would require such assistance as it was proposed to afford. The minutes were, however, confirmed.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1901.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, Manchester, and Birmingham, to whom all inquiries should be addressed.

11,838. "Improvements in regulators for electric or other motors operating air or other fluid compressors." P. M. Justice. (The "Long Arm" System Company, United States.) June 10th.

11,845. "Improvements in or relating to electric wire switch couplings." A. J. Adkins. June 10th.

11,847. "Improvements in or relating to electrostatic instruments." G. L. Addenbrooke. June 10th. (Complete.)

11,854. "Improved automatic electric cut-out for overhead wires or conductors." D. A. Lowery. June 10th.

11,857. "Improvements in armature windings for dynamo-electric machines." E. Arnold and F. Collischonn. June 10th.

11,922. "Improvements in or relating to electric meters, motors and methods of compensating for phase displaced currents. L. Gutmann. June 11th. (Complete.)

11,925. "Improvements in apparatus for connecting the ends of electric cables and the like." H. H. Lake. (F. H. Stillman, United States.) June 11th. (Complete.)

11,931. "Improved method of regulating and controlling the speed or power of electric motors." W. L. Allcroft. June 11th.

11,949. "Improvements in electric telegraph apparatus." F. H. Littlefield. June 11th. (Complete.)

11,951. "Amperemeter for the registration of the maximum consumption of electrical energy." H. Helberger. June 11th. (Complete.)

11,992. "Improvements in means for accentuating electrical contacts." The British-Thomson-Houston Company, Limited. (E. Thomson, United States.) June 12th. (Complete.)

12,016. "Framework for alternating current electrical machines." Siemens Bros. & Co., Limited. (Siemens & Halske Aktiengesellschaft, Germany.) June 12th.

12,020. "Improvements in electricity meters." G. Hookham. June 12th.

12,023. "Improved mechanically operated and electrically controlled alarm apparatus." W. Kielpinski. June 12th. (Complete.)

12,061 "Improvements in etheric telegraphy." The Scottish Wireless Electric Syndicate, Limited, and W. Jamieson. June 13th.

12,071. "Electrical ignition and valve operating mechanism for oil or petrol engines for motor cycles." S. De Jong. (Date applied for under Patents, &c., Act, 1883, Sec. 103, December 22nd, 1900, being date of application in Belgium.) June 13th. (Complete.)

12,088. "Improved method of and means for taking electric current from transformers." G. Weissmann. (Date applied for under Patents, &c., Act, 1883, Sec. 103, December 5th, 1900, being date of application in France.) June 13th.

12,089. "Improvements in automatic electrical signalling apparatus for railways." J. E. Spagnoletti. June 13th.

12,094. "Improvements in electric cables." F. Tremain. June 13th.

12,119. "A new or improved method of and combination of apparatus for translating and relaying telegraph cable signals." J. P. Gorton. June 13th. (Complete.)

12,121. "Machinery for pressing the copper segments and insulating strips of electric commutators into annular form." A. F. Petch. June 14th.

12,134. "Improvements in or relating to electric arc lamps and electrodes therefor." C. A. Lee. June 14th.

12,139. "An improved device for the prevention of accidents from overhead trolley wires." C. Jones. June 14th.

12,153. "Improvements in electrically propelled cycles, auto-cars, and other like vehicles." C. Adams-Randall. June 14th.

12,195. "Improvements in and in the construction of electrodes." W. P. Thompson. (R. J. Gulcher, Germany.) June 14th.

12,210. "Improvements in electrostatic separators." C. E. Dolbear. June 14th. (Complete.)

12,217. "Improvements in coin-actuated medical batteries." N. M. Watson. June 14th.

12,218. "Improvements in electric clocks and automatic alarm transmission." G. B. Bowell. June 14th.

12,220. "Improvements in electric telegraphy." P. M. Justice. (The Rowland Telegraphic Co.) June 14th. (Complete.)

12,223. "Improvements in or connected with the field regulation of electro-dynamic machinery." J. C. Wilson. June 14th.

12,330. "Improvements in ceiling roses for use in electric lighting." J. W. Gilbert. June 15th.

12,941. "Improved manufacture of electric illuminating bodies." W. Boehm. June 18th. (Complete.)

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, Manchester and Birmingham, price, post free, 9d. (in stamps).

1899.

19,031. "Improvements in driving and steering gear for electrically-propelled motor road vehicles." E. Kuhlstein and J. Vollmer. Dated September 21st, 1899. Relates to controlling and steering levers for electrically propelled vehicles, the forward or backward movement of which lever controls the driving gear and the rotary movement of which regulates the steering gear. The fulcrumed tube is connected to the controlling switch so that this switch is adjusted by forward and backward movement. The lever is held in any one of the several positions desired by the engagement of rounded notches in parts, one of which is held resiliently by a spring. In the tube is the steering shaft, which, in order to permit it to swing with the tube, is connected to the linkage for adjusting the steering wheels by a swivelling link. Modifications are described in which the link and the switch are adjusted by a rack and pinion. 2 claims.

19,103. "Improvements in telephone conductors or cables." The Joint Stock Company and J. Lappe and A. Hohnholz. Dated September 23nd, 1899. Cables for use with telephones have the conductors surrounded by an open spiral of iron or copper wire and an outer insulation of paper, &c. The spiral may be broken at various predetermined positions, and the wire is silk, &c., covered, or the conductor may be covered and the wire bare. 1 claim.

19,112. "Improved filling mass or active material for the production of solid accumulator plates." C. F. P. Stendebach and H. M. F. Reitz. Dated September 23nd, 1899. In order to render the active material more cohesive and porous, saccharine matter, in addition to the usual binding materials, is added to it.

The binding material may be a mixture of glycerine and sulphuric acid. In order to shorten the drying process, the plates after having been dried in the air are steeped in linseed oil, and are then formed in the usual way. 1 claim.

19,189. "Means and apparatus for electrically-working vacuum and air-pressure railway brakes." Siemens Brothers & Co., Limited. (Siemens & Halske, Aiktien, Gesellschaft.) Dated September 23rd, 1899. Relates to pneumatic brakes for electrically-propelled trains. This specification is described at length, and is too complicated for purposes of abridgment. 13 claims.

19,261. "Improvements in means for electrically re-winding clock or similar mechanism." The British Thomson-Houston Company, Limited, and F. Holden. Dated September 25th, 1899. Winding mechanism for mainsprings, has one end attached to a post and the other to the arbour of a ratchet wheel engaged by a pawl on the first wheel of the movement. The mainspring arbour bears the arbour of an electro-magnet, and when the mainspring is unwound enough the circuit, which includes the frame plate, is completed by the contact between a wing piece on the armature and a magnetic strip which overlaps it. The closure of the circuit first occurs by the contact of lugs on the wing piece, with turned-down lugs on the strip, but it continues till the armature is nearly in the line of the poles, because the strip is attracted into contact with the wing. A condenser and resistance are added to prevent sparking. In a modification specially adapted for use with alternating currents the attracted terminal is made much lighter, and the other wing of the armature first completes the circuit by momentary contact with a stiff terminal. 2 claims.

19,285. "Improvements in rail bonds for electric railways." T. J. McTighe. Dated September 26th, 1899. Rail bonds are made in one piece by upsetting the ends of a length of wire or rod and then pressing them to form the heads, leaving a shoulder round the heads. The body is flattened, slit, and bent or opened out, and also may be crimped to add to the flexibility. A conical countersink is made in the heads to facilitate the spread of the metal when they are inserted in the rails. 2 claims.

19,354. "Improved thermophor with electric heating arrangement." T. Timar. Dated September 26th, 1899. Thermophors with electric heating arrangements and used for heating provisions, electrically-driven carriages, tramway vehicles, &c., are described as follows:—A doubled walled vessel contains the acetate of soda, &c., and has a non-conducting covering. The central chamber contains wires through which an electric current is passed, which melts the crystallised material. The wires may be variously arranged and may pass through tubes inserted in the double-walled vessel to start the crystallisation of the melted material, the vessel may be fitted with a pointed screw, which is withdrawn from and re-inserted into the material. As adapted for heating provisions, the vessel is provided with a central chamber, and is fitted with a lid. 1 claim.

19,440. "Improved apparatus for periodically producing electric current by means of irregular motive-power." M. Gehre. Dated September 27th, 1899. Relates to apparatus for producing electric current in a regular manner from an irregular source of power, such as the wind. The motor shaft drives, through toothed gearing and a pawl, either one or a pair of chain pulleys, over which pass endless chains carrying a weight or weights. When the weights have been raised and carried over the pulleys, the pawl becomes disengaged, and they descend on the other side, the device then acting as a weight motor, When the weights reach the bottom, the pawl again comes into engagement, and they are lifted as before. A gear-wheel drives the electric generator. 2 claims.

19,445. "Improvements relating to electric lighting systems." A. Blondel, G. Weissman and A. Wydts. Dated September 27th, 1899. In order to use lamps of low voltage—*e.g.*, 20 volts—with a comparatively high tension in the mains, transformers are arranged in close proximity to each lamp or group of lamps. One arrangement comprises a main switch and transformers. The transformer may be placed on the wall or in the ceiling or wall-rose, or in the foot of a supporting standard. The transformers have preferably a single winding, with the lamp, or lamps, connected up with sections. The system is also adapted for groups of small lamps of about 2 C.P. 4 claims.

19,539. "Improvements in connection with automatic electric circuit-breakers for automatically closing the circuit after breaking." B. Hopkinson and E. Talbot. Dated September 28th, 1899. Relates to means for automatically closing magnetic circuit-breakers after they have opened a circuit. An electromotor is connected to the circuit, and through a clutch or gearing closes the cut-out. In one arrangement the arm of the circuit-breaker is fixed on a shaft on which is also fixed a disc carrying an iron ring. Loose on the shaft is an iron disc in which is embedded the coil. To this disc is attached a worm-wheel driven through gearing by a motor. The coil is connected to rings on which rub brushes carried by the brush-holder. A contact engages with a specially-arranged quadrant on the disc. With an abnormal current the core is raised and a catch released. The arm of the circuit-breaker is then thrown out by a spring and the circuit opened. At the same time a switch is opened and the fixed disc rotated, making contact with the contact. So long as the excessive current continues through the shunt coil of the circuit-breaker the core is held up, but on the resumption of normal conditions the core falls and closes the switch. Current is now supplied to the coil of the magnetic clutch and to the motor, the shaft is thus rotated and the arm moved to close the circuit. In a modified arrangement the fine wire coil around the core is dispensed with. In another form of the invention two circuit-breakers are employed and are alternately closed by arms mounted on a shaft rotated by the motor. In order to prevent continuous rotation of the motor, a switch may be arranged to cut out the motor when both circuit-breakers are closed. 9 claims.

19,618. "Improvements in laminated armatures for dynamo-electric machines." J. Burke. Dated September 29th, 1899. A laminated armature core is provided with slots so arranged, that part of the magnetic flux is forced to follow a defined course for the purpose of increasing the magnetic saturation in the armature teeth, and also as a means for obtaining a more uniform distribution of the magnetic flux in the air-gap. The form of the slots may be considerably varied, and the invention may be applied both to toothed and to smooth armature cores. 1 claim.

19,640. "Improvements in electro-magnetic wave apparatus." J. T. Armstrong and A. Orling. Dated September 29th, 1899. Relates to the arrangement of oscillator and coherer in electro-magnetic radiation apparatus. The two oscillator spheres are mounted on adjustable supports, and situated in an oil bath, and separated by an insulating screen. The spheres are hollow, and are provided with valves half drilled, so as to allow a number of small metal balls to be inserted or removed therefrom one at a time. The coherer consists of a tube with electrodes secured hermetically in the ends, the cohering material consisting of a number of metal pellets of suitable size and number to act syntonically with the oscillator. Decohering may be obtained by a transverse permanent or intermittent magnetic field. 6 claims.

19,678. "Improvements in lightning conductors." K. W. Hedges. Dated September 30th, 1899. The various parts of lightning conductors are joined together by forming a trough round a tinned part of the conductor and its connecting portion, point, or other branch, and filling the trough with fusible metal. The trough or mould may be divided and capable of contraction by screws in the case of attaching the conductor to a pipe. In attaching the conductor to a pipe. In attaching the conductor to a gutter, &c., a plastic joint may be employed. In the case of ground plates, the plate may have several parallel cuts, the portions being bent alternately so as to receive the conductor, which is soldered into position. A ground connection consists of a tube driven into the ground and down which the sheathed conductor passes. The tube is packed with carbon, and the conductor is soldered to the cap. An elbow is supplied for keeping dirt out and for the supply of moisture. 2 claims.

19,710. "Improvements in wireless telegraphy." S. G. Brown. Dated October 2nd, 1899. Coherers for wireless telegraphy are constructed with magnetic contacts excited, preferably alternating or periodic currents. In one arrangement, two laminated pole-pieces have between them magnetic filings such as nickel, the pole-pieces and filings being in some cases plated with gold or silver. The pole-pieces and filings may be arranged in an exhausted glass tube, or may be immersed in oil or an electrolyte. The pole-pieces may have an external exciting yoke on which the coils are placed, and the magnet may be excited by direct current and de-coherence obtained by alternating. A permanent magnet, either rotating or fixed, may also be employed external to the tube, or a magnetic chain may be formed between two pole-pieces, one of them having coils for direct and alternating currents. A single-point magnetic coherer is also described in which de-coherence is obtained by an alternating current magnet. The magnetic coherer may also be mechanically de-cohered. The receiver may be arranged to act through a drum relay with choking and curbing devices, as in high-speed cable working. A siphon recorder may also be used, vibrating in a plane at right angles to the tape. A telephone may be used with the single-point coherer. A "Weston" milliampere meter may also be used as a receiver; the pointer, being broadened, may cover and uncover a spot of light. 6 claims.

19,781. "Improvements in or relating to electrical switches." S. A. Hunter. Dated October 2nd, 1899. Switches of the tumbler type.—The base is formed with two projecting pieces, the former separating the contacts and carrying the support for the tumbler lever. The movable contact lever is pivoted to one of the two projecting pieces, and has a connecting cross-piece and an insulated crossbar. The tumbler lever presses on this bar, and is so shaped that the contact lever moves quickly at first and then more slowly. A spring gives a quick break, a positive movement being given by a loop. 5 claims.

19,785. "Electro-chemical process for cleansing metal surfaces." Vereinigte Elektricitats Actiengesellschaft and J. Klaudy. Dated October 3rd, 1899. Pickling metals by.—A metal surface is electrolytically cleaned, by first suspending it as a cathode in a salt solution to remove grease, and afterwards using it as an anode or cathode, according to the metal under treatment, in an electrolytic cell containing an electrolyte which can be regenerated. When treating iron, copper, copper alloys, and similar metals, they are arranged as anodes, and the electrolyte is one which will attack the metal and form a soluble hydrate on the cathode. This hydrate will then combine with the acid of the metallic salt formed, precipitating the metallic hydrate, and reforming the original electrolyte. For iron, sodium sulphate is the electrolyte employed. Zinc, aluminium, and like metals are treated when connected up as cathodes, unattackable anodes being employed. In this case, also, an insoluble hydrate of the metal is precipitated, by means of a secondary reaction between the soluble compound formed at the cathode, such as zincate or aluminate, and the acid set free at the anode. The electrolyte is withdrawn, either continuously or intermittently, fined and filtered, and then returned to the cell. 5 claims.

19,793. "Improvements in or relating to the electric plating and burnishing of certain articles, and in apparatus to be used therein." B. J. Round and A. Round. Dated October 3rd, 1899. Plating small articles.—Refers to Specification No. 4,865, A.D. 1899, in which Albert chains, curb bracelets, necklets, and the like and gilded or otherwise coated in a rotating perforated barrel or the like, and consists (1) in imparting to the barrel by any suitable means, in addition to its rotary motion, an intermittent up-and-down, or oscillating motion, and (2) in dividing the barrel transversely or both tranversely and longitudinally by partitions. Rumbles and tumbling-barrels.—To obviate the hand burnishing of articles which have been electro-plated, they are placed in a small perforated vessel or barrel together with a quantity of steel balls or equivalent small bodies having a hard polished surface, and the barrel is rotated within a bath containing some suitable lubricant such as soap-suds. 3 claims.

19,818. "Improvements in the construction of wicks for oil lamps which are electrically lighted." R. O. Best. Dated October 3rd, 1899. Wicks for miners' safety and other oil lamps which are ignited by electricity, are formed to act as electrical conductors. One or more strips of thin metal or foil are embedded in, or attached to, the cotton or other fabric, one end of the strip projecting beyond the fabric to trail within, and to make contact with, the metallic oil reservoir. 1 claim.

19,846. "A new or improved conduit terminal and junction box for electric wires." R. McKean Thomas. Dated October 3rd, 1899. A junction or terminal box for the tubes employed in laying electric conductors is formed in two parts fitting together, the face of one over the inner one. The two parts are each provided with semi-circular openings and projecting masks, or partially reduced portions for forming such openings. The lower surfaces are radially raised and slotted. The front of the outer case has a raised portion, circular in shape, and preferably provided with a detachable lid held in position by lugs. The ends of the conduit-tubes are screwed and provided with circular nuts having central annular recesses which fit into the openings in the cases. The corners of the inner portion have guide-pieces for the outer case. 5 claims.

19,856. "Improvements in magnetic separators." W. Clark. (C. F. Courtney.) Dated October 3rd, 1899. A separator comprising rotary magnets may be submerged under water. Two drums of gun-metal or other non-magnetic material are secured by means of screws to the expanded ends of shafts which are mounted to rotate within stuffing-boxes fitted in the sides of a tank. The shafts formed of soft iron serve as the cores of electro-magnets, the coils of which are stationary and are supported by brackets. The reduced ends of the shafts are connected by soft iron bars, provided with apertures to receive the ends of the shafts. Series of tapering pole-pieces are secured to the ends, and are partially embedded in recesses formed in non-magnetic drums; or these pieces may be secured by means of white metal or the like. The magnetic polarity of one set of pole-pieces is opposite to that of the other. The shafts are connected by means of gearing, and carry toothed wheels for driving the feed-rollers, arranged beneath the hoppers for supplying ores or other materials to be treated. Receivers for magnetic and non-magnetic materials respectively are arranged beneath the magnets, and fixed brushes serve to remove the magnetic materials adhering to the drums. The pole-pieces may form part of rings shrunk upon the shafts. 9 claims.

19,867. "Improvements in or connected with telegraphic apparatus." A. C. Crehore and G. O. Squier. Dated October 3rd, 1899. Relates to automatic transmission with undirectional or alternating pulsating currents by means of perforated or indented strips. In one arrangement of the apparatus the pulsating generator is connected to reversing-mechanism similar to that described in Specification No. 21,687, A.D. 1893, the magnets being excited by the local circuits when either of the brushes passes over a perforation. The tape is driven by gearing from the generator shaft, so as to produce the travel of one space for each semi-cycle. The position of the brushes may be adjusted as described in Specification No. 4,931, A.D. 1899. When alternating impulses are employed, the reversing-mechanism may be controlled by polarised relays in local circuits with a battery and reversing-commutator. In another arrangement, the battery commutator is omitted. Methods are described of obtaining pulsating unidirectional or alternating current from a constant source of current by means of resistances or cells connected to contact points swept over by a rotating brush attached to one line, the other line being connected to either one end or the centre of the source. Where an alternating source of current at a distance is employed, such source may be connected to a synchronous motor, and, if necessary, a rectifier. 5 claims.

19,941. "Improvements in electric tramcars with overhead collectors." W. H. Pick. Dated October 5th, 1899. A water-tight joint in a temporary or permanent roof of a tramcar, allowing angular and swivelling movements for the trolley pole, is formed by a dome, preferably made in two parts connected by flanges and mounted concentrically with the standard on ball bearings in a flanged rim. The pivoted trolley pole passes through a slot in the dome and an india-rubber sleeve, surrounds the slot and pole. 1 claim.

20,002. "Improvements in electric motors." A. Heyland. Dated October 5th, 1899. Motors, alternating current.—In order to obtain a large difference of phase between the currents in the two windings of a single-phase motor, and consequently a powerful starting torque, one of the windings is placed in grooves in the iron body, which are either open or imperfectly closed, while the other winding is placed in grooves or holes, closed by a considerable amount of iron. 1 claim.

20,189. "Improvements connected with indicating or recording and controlling the speed of electric railway cars or vehicles and other machinery." G. H. Nisbett. Dated October 9th, 1899. Relates to means for indicating or recording and controlling the speed of electric railway cars or vehicles and other machinery. A small dynamo-electric generator is driven by the electric motor or by the wheel, axle, or other part operated thereby, and the current generated by the dynamo is employed to actuate a deflecting electric indicator. In the form described the indicator arm traces a diagram on a chart, mounted on a revolving barrel and graduated so as to indicate miles per hour. The circuit of the dynamo also includes an automatic switch which cuts off the supply of current to the motor when the latter attains a certain speed. When the speed falls, the automatic switch again closes the motor circuit. An electric brake of any suitable type may be employed in conjunction with the automatic switch. 3 claims.

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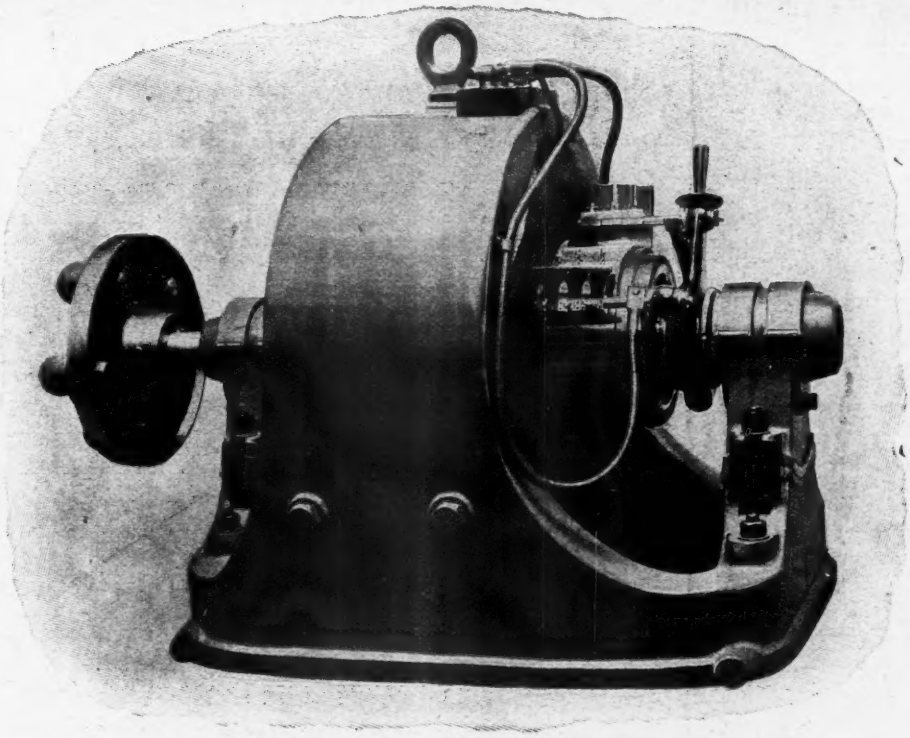

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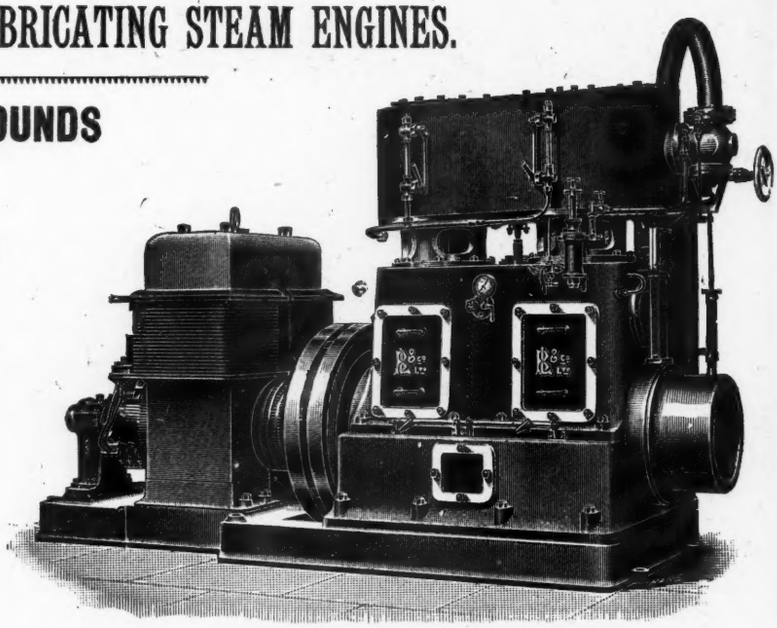

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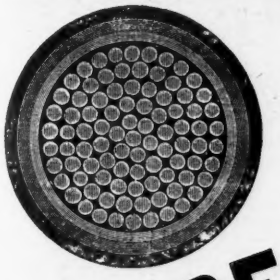

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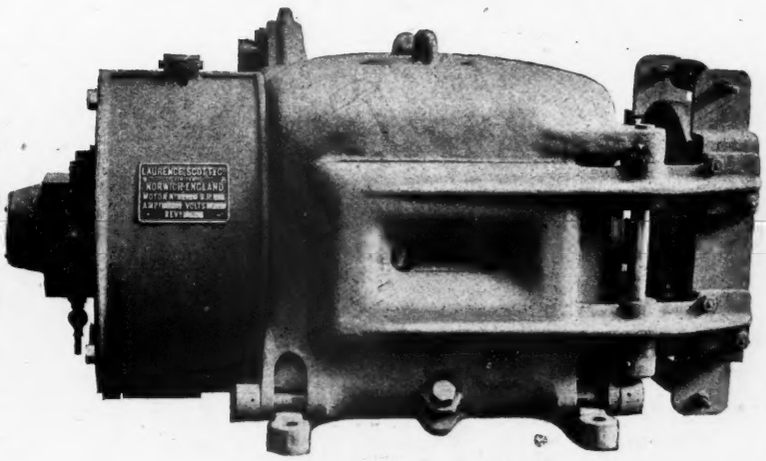

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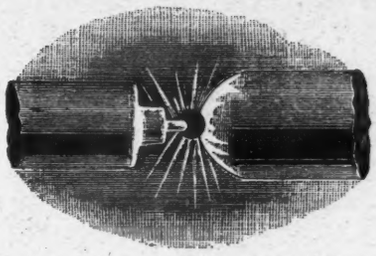
The G quality is made for a consumption of from ⅞ in. to 1 in. per pair per hour, and our W and A Alternating and Enclosed Arc Lamp Carbons are not surpassed for light and absence of ash.



The "SHIP" Carbons take a less number of Watts per candle-power without diminution of the Arc than those of other makers.

FOR PRICES APPLY TO—

DE GRELLE, HOUDRET & CO., ELECTRICAL AND MECHANICAL ENGINEERS,

130, LONDON WALL, LONDON, E.C.

Sole Agents for Schiff & Co.'s "Ship" Carbons.

Telephone: London Wall 1858. Telegraphic Address: "DEGRELLE, LONDON."

ELLIOTT BROTHERS,

CENTURY WORKS,

LEWISHAM, S.E.

ELECTRICAL INSTRUMENTS OF ALL KINDS.

RECORDERS—Ammeters, Voltmeters, Wattmeters

FOR DIRECT AND ALTERNATING CURRENTS.

WESTON AMMETERS AND VOLTMETERS.

NEW PRICE LIST.

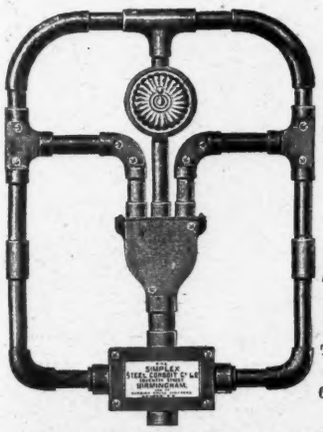
REDUCTION IN PRICES.

GOLD MEDAL,

PARIS, 1900.

The SIMPLEX STEEL CONDUIT CO., Ltd., have pleasure in announcing a Further Reduction in Price of their Enamelled, Brazed, Galvanised and Screwed Steel Conduits, as from 1st APRIL, 1901.

FOR PARTICULARS SEE NEW PRICE LIST



TRADE MARK.

The system has now become almost universal in Installation Work. It is specified by Consulting Engineers and Architects. Insurance Offices and Central Station Engineers recommend it.

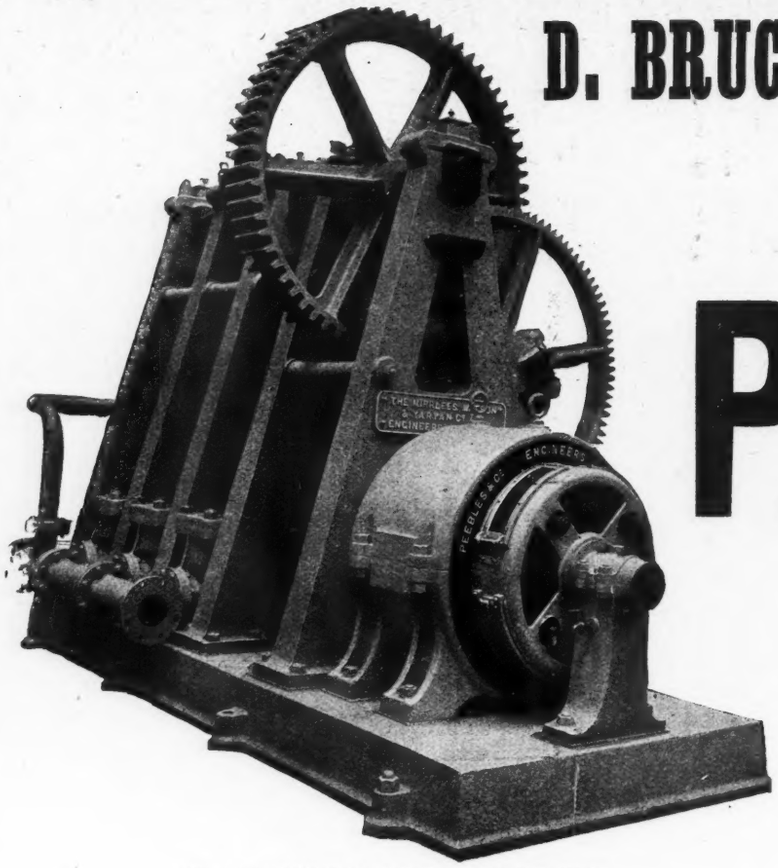
REDUCTION IN FIRST COST, ERECTION COST AND MAINTENANCE COST.

THE SIMPLEX STEEL CONDUIT CO., Ltd.,

Tel. No. 2955. Telegrams: "Economy, Birmingham." **Coventry Street, BIRMINGHAM.**

6052, Bank. "Audiphone, London." **20, Bucklersbury, LONDON, E.C.**

9025. "Economical, Manchester." **1, Peel Street, MANCHESTER.**



D. BRUCE PEEBLES & CO.,

TAY WORKS,
EDINBURGH.

P.P.P.

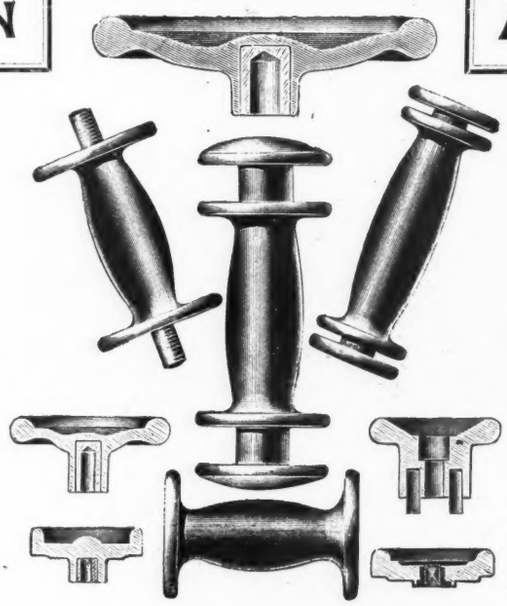
Motors, Open and Enclosed, for every description of rough usage.

Machines for Electric Transmission of Power in Works of every description.

100 B.H.P. COMBINED MINING MOTOR AND PUMP.

Over **1000** *Motors of this type supplied annually by us.*

AMBROIN AMBROIN



DOUBLE-POLE HANDLES HAND WHEELS.

WRITE FOR STANDARD BLUE PRINTS.

ESTLER BROTHERS,

25, LAURENCE POUNTNEY LANE,
CANNON STREET,
LONDON, E.C.

Telephone No. 6098, BANK,
Telegrams:—"ISOLABLE, LONDON.

AMBROIN AMBROIN

HIGH EFFICIENCY

LOWRIE-HALL PATENT. **Transformers,** INTRODUCED IN 1888. THOUSANDS IN USE.

ALTERNATORS,

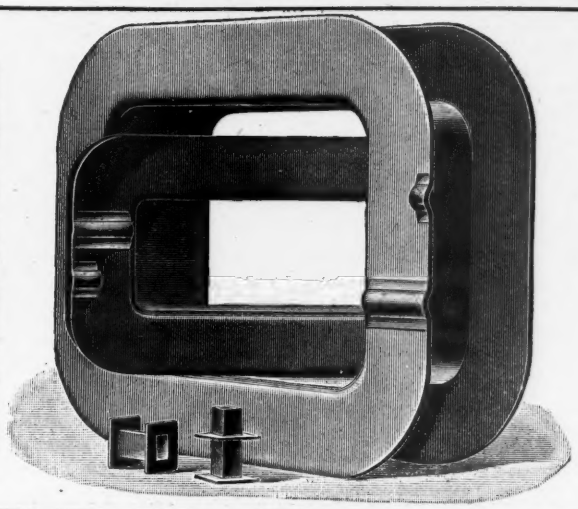
Dynamos, Motors, Switchboards,

COMPLETE ELECTRICITY WORKS EQUIPMENT.

JOHN FOWLER & CO. (LEEDS), LD., HUNSLET, LEEDS. Works:

WORKS USING OUR APPARATUS:—Leeds, Eastbourne, West Brompton, Madrid, Dublin, Burton-on-Trent, Reading, Islington, Avila, Coventry, Blackpool, Newport, Toro, Buenavista, Sanildefonso, Ayr, Wakefield, Halifax, Harrogate, Newport, Beckenham, Bury St. Edmunds, Bangor.

IN PROGRESS:—Leeds Electric Tramways, Heckmondwike, Batley, Salford, Worthing &c. 8483



Bobbins for Dynamos, Motors and Transformers.

GEBRÜDER ADT,

ENSHEIM, PFALZ, GERMANY,

MANUFACTURERS OF

ELECTRICAL ISOLATING MATERIALS, viz.:

ISOLATING CONDUIT-TUBES WITH and WITHOUT METALLIC COVERS, to enclose electrical conducting wires, elbows, corner pieces, as well as slidings, for the complete installation of electrical conduit tubes; further, PROTECTING BOXES, DERIVATION BOXES, and JUNCTION BOXES of every description.

INSULATED CASES for Dynamos, Motors and Transformers.

PRIMARY BATTERY VESSELS FOR ELEMENTS.

ACOUSTIC TRUMPETS FOR TELEPHONES AND MICROPHONES.

SHADES (Reflectors) for Lamps, DOWN RODS, BRACKETS, and all Appliances for Electrical Fittings and Accessories, Practicable and Unbreakable.

Agency and Depôt:—

ARCHIBALD CAMPBELL,

28, GRAY'S INN ROAD, LONDON, W.C.

"C. & C." NEW "FOUR-POLE" TYPE DYNAMOS AND MOTORS.

LISTS ON APPLICATION TO

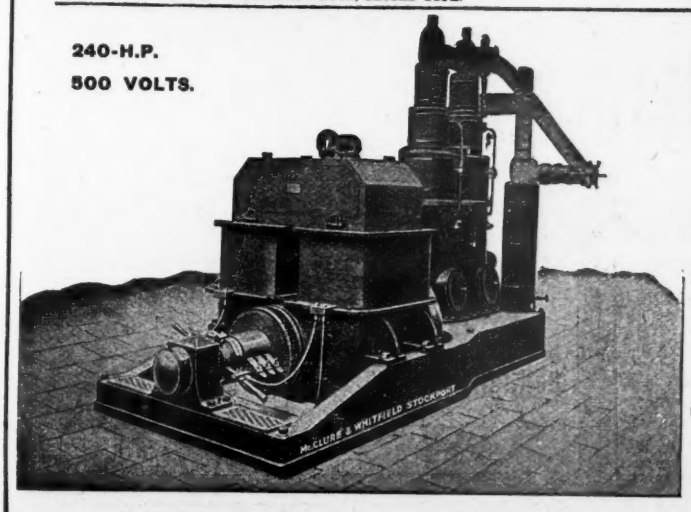
C. R. HEAP, Sole Importer, 47, Victoria Street, LONDON, S.W.

"C. & C." FOUR-POLE MOTOR, CLOSED TYPE.

"C. & C." FOUR-POLE MOTOR, OPEN TYPE. 8056

240-H.P.

500 VOLTS.



McClure & Whitfield,

STOCKPORT.

MERSEY DYNAMOS & MOTORS

DYNAMOS

For Arc and Incandescent Lighting, Transmission of Power, Electro plating and Depositing, Electrolysis.

MOTORS

For Driving Cranes, Hoists, Pumps, Tools, and all Classes of Machinery.

CENTRAL STATION AND SHIP LIGHTING COMBINED PLANTS.

Prices and Full Particulars on application.

London Representative—R. C. TAYLOR, 150, Leadenhall Street, E.C.

Telegrams: "Motors, Stockport." Telephone No. 120 Nat.

COURSES IN

ELECTRICAL ENGINEERING

for those who wish to study from the very beginning to the most advanced subjects in electricity. Prepared by the best practical experts.

ELECTRICAL ENGINEERING,
Telephony, Telegraphy, Electric Lighting, Electric Railways, X-Rays, Electric Mining, Short Electrical Course.

MECHANICAL ENGINEERING
STEAM ENGINEERING,
MECHANICAL DRAWING, &c.

Write for our Illustrated Book, "Can I become an Electrical Engineer?" Sent free.

Our system of Correspondence Instruction has helped thousands to better positions and salaries. Terms are within reach of all. Our Institute is endorsed by Thomas A. Edison and other prominent men of U.S. and England.

I consider the Electrical Engineer Institute as conducted by Messrs Wetzler and Martin to be of great value to those who desire an Electrical education
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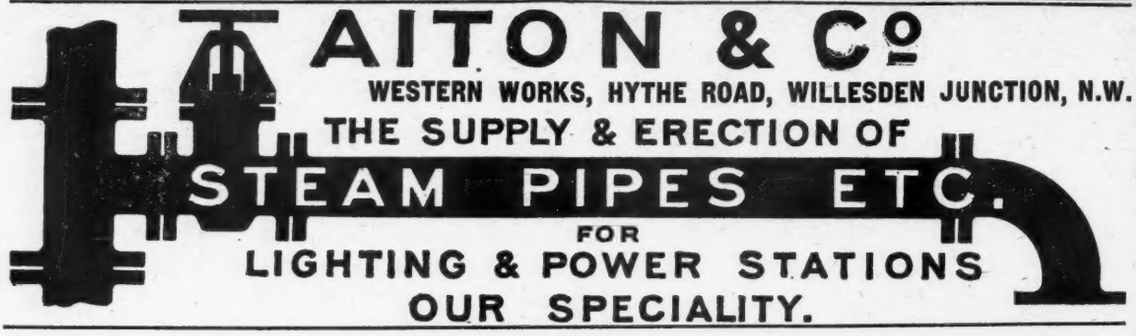
The Electrical Engineer Institute of Correspondence Instruction,
Dept. 3, 240 and 242, West 23d St., New York, U.S.A.
Jos. WETZLER, M.E., E.E., Pres. T. COMMERFORD MARTIN, Vice.-Pres. 497



AITON & Co

WESTERN WORKS, HYTHE ROAD, WILLESDEN JUNCTION, N.W.

THE SUPPLY & ERECTION OF

STEAM PIPES ETC.

FOR

LIGHTING & POWER STATIONS

OUR SPECIALITY.

VULCANIZED RUBBER CABLES.

OUR RUBBER IS GUARANTEED TO CONTAIN NO SUBSTITUTE.

Our production in large and small cables averages in every 24 hours 70,405 yards. Delivery, specially of large cables, from stock.

THE ST. HELENS CABLE CO., Ltd.,

WARRINGTON.

Scottish Agency: 19, WATERLOO STREET, GLASGOW.

ENGLISH MANUFACTURE.

Unaffected by Stray Fields.

Dead Beat. High Insulation.

Prices from **30s.** *Write for Particulars.*

UNIVERSAL AMMETERS & VOLTMETERS

CAN BE USED INDISCRIMINATELY FOR DIRECT or ALTERNATING CURRENTS.

NOT a Hot-Wire Instrument.

EVERETT, EDGCUMBE & CO.,

22, CHARTERHOUSE SQUARE,

Telephone, 1052 HOLBORN. LONDON, E.C.

Showrooms: 11, VICTORIA ST., WESTMINSTER.

A.B.P.

STORAGE BATTERIES

ON ORDER FOR

MEXBOROUGH AND DEVONPORT

CENTRAL STATIONS.

Ashmore, Benson, Pease & Co., Ltd.,

STOCKTON-ON-TEES,

MAGUIRE & BAUCUS,
ELECTRIC RAILWAY SUPPLIES,

5, Warwick Court, Holborn, London.

SPECIALITIES:

THE CAHALL WATER-TUBE BOILER.
PHONO-ELECTRIC and HARD-DRAWN COPPER TROLLEY [WIRE.
"ARMORITE" FLEXIBLE STEEL CONDUIT.
THOROUGHLY VITRIFIED TILE CONDUITS.

THE
'ALLAN' ACCUMULATOR
The Accumulator for Hard Work.

THE "ALLAN" PLATE cannot buckle owing to its construction. The active material is contained in one solid mass, and is not subdivided in any way. The grid is in the form of an envelope cast in one piece, with provision for expansion.

ALLAN ACCUMULATORS give a greater capacity per lb. weight than any others on the market, and achieve this result without diminishing the mechanical efficiency of the plate.

FOR LISTS AND ALL PARTICULARS WRITE TO—

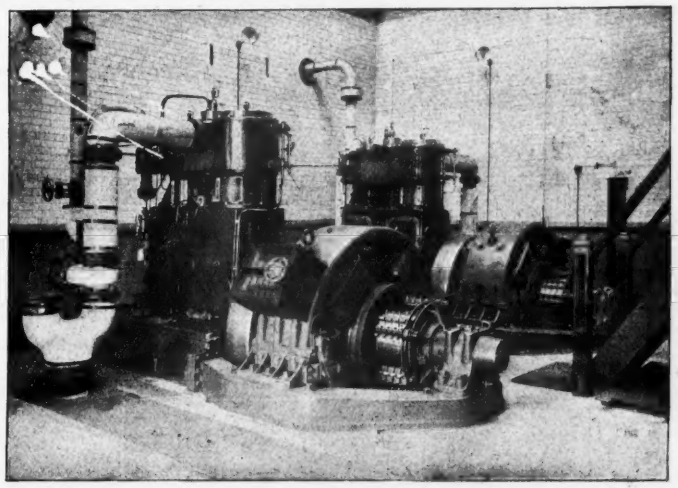
ALLAN & ADAMSON, Ltd.,
CRAMPSHAW LANE, ASHTEAD, SURREY.

THE ALLAN ACCUMULATOR WORKS.

SCOTT & MOUNTAIN,
Electrical and General Engineers, NEWCASTLE-ON-TYNE. LTD.,

London Office: 20, NEW BRIDGE STREET, BLACKFRIARS, E.C.

Electric Transmission of Power Machinery of all descriptions.



Electric Lighting of all descriptions.

2—240 H.P. Steam Generators in New Chester Road Power Station supplied for the Birkenhead Corporation Electric Tramways.

STEAM DYNAMOS.

750 H.P. for Hill of Howth Electric Railway, Dublin.
400 " " Darlington Corporation.
580 " " Birkenhead Corporation.
560 " " Worksop Corporation.
480 " " Worthing Corporation.

H

NALDER BROS. & THOMPSON'S N.C.S.

RECORDING AMMETERS and VOLTMETERS.

AS SUPPLIED TO THE LEADING CENTRAL STATIONS AND CONTRACTORS.

Suitable for DIRECT or ALTERNATING CURRENT.
When ordering state periodicity.

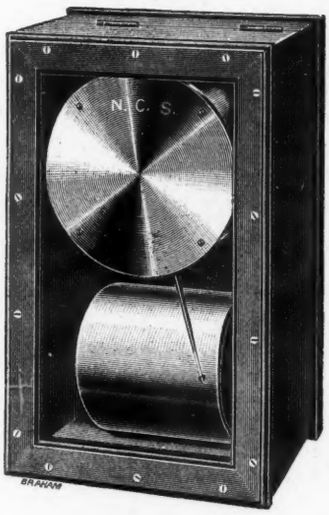
AMMETERS.

Range in Amperes.	Code Word.	Price. £	s.	d.
50	Racehorses	10	0	0
100	Racer	10	0	0
150	Rachidian	11	0	0
200	Racial	11	5	0
300	Rackrail...	11	10	0
400	Rackrenter	12	5	0
500	Rackstick	13	0	0

Range in Volts.	Code Word.	Price. £	s.	d.
90—130	Rackwork	10	10	0
180—260	Racquets	11	11	0
360—520	Raconda...	13	0	0

For ALTERNATING CURRENT VOLTMETERS add *£3* to above.

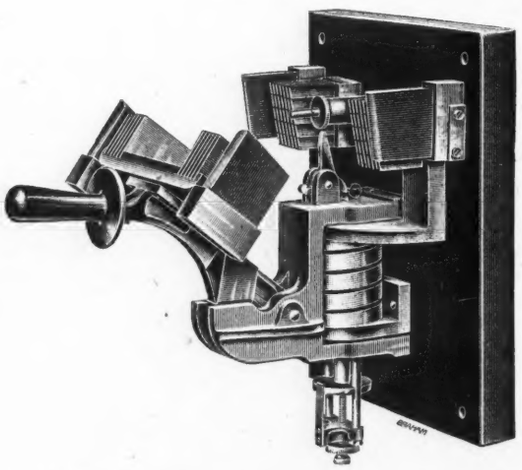
N.C.S.



Permanent Magnet Moving Coil Recorders.

PRICES AND PARTICULARS ON APPLICATION.

Portable Recording Ammeters and Voltmeters.



N.C.S. Automatic Circuit Breakers.

Made for Breaking on—

Overload,
Underload,
Overload and Underload Combined,
Overload and No Pressure Combined.

NALDER BROS. & THOMPSON, Ltd.,

34, QUEEN STREET, CHEAPSIDE, LONDON, E.C.

Telegrams:—"OCCLUDE, LONDON." Telephone No 124 Bank.

☛ **CATALOGUES FREE ON APPLICATION.** ☚

AGENTS:—Mr. S. JEVONS, Electric Stores, Minories, Birmingham; W. McGEOCH & Co., 108, Argyle Street, Glasgow; and Messrs. SIMON, BERRY & Co., 65, King Street, Manchester.

WALTHAM'S ARTISTIC SWITCHES BELL PUSHES, etc.

COMPRISING QUAINT PANNELLED OAK ROOM and a MODEL DRAWING ROOM

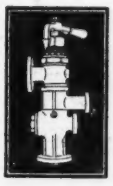
FIVE SHOWROOMS AT

For the CONVENIENCE OF ELECTRIC LIGHT CONTRACTORS.

THE WALTHAM ART METAL & ENGINEERING CO., 46, York St., Buckingham Gate

Telegrams:—"Switchboard, London." (Near St. James's Park Station), LONDON, S.W.

Injectors



One movement starts the "SIRIUS" Injector and adjusts both steam and water cones, dispensing with valves in steam and suction pipes and requiring no skill to operate. Automatic re-starting. Lifting or non-lifting. Takes hot water and feeds through heaters and economisers.

Holden & Brooke, Ltd
SIRIUS WORKS MANCHESTER & 110, CANNON ST LONDON, E.C.

Official Notices.

DISCLAIMER.

WE REGRET that we have issued Circulars offering for sale Fuse Boxes, as covered by the Letters Patent of Henry Reason, No. 5863, dated 21st day of March 1894, which Letters Patent are now the property of the Reason Manufacturing Company, Limited, of Lewes Road, Brighton. This matter having been brought to our notice, we have at once discontinued the sale of these Fuse Boxes, and, in future, will not accept orders for same.

FRANCIS & SPILSBURY,
20, Bucklersbury,
London, E.C.

June 24th, 1901. 3579

STEPNEY BOROUGH COUNCIL.

ELECTRIC LIGHTING.

Contracts Nos. 18 and 19.

THE ELECTRICAL COMMITTEE of the Stepney Borough Council require Tenders for the supply of the following Plant and Cables:—

Contract No. 18.—Steam and other Pipe Work.
Contract No. 19.—Paper-insulated Cables, Earthenware Conduits, &c.

Contractors may tender for both, or either contracts. Copies of Specifications and Forms of Tender may be obtained by application to the undersigned on or about Thursday, July 4th, 1901, on payment of the sum of Two Guineas each Specification, which amount will be returned on receipt of *bona fide* tenders.

The Council do not bind themselves to accept the lowest or any tender, and the acceptance of any tender is subject to the consent of the London County Council being obtained to the borrowing of the capital monies.

Tenders, endorsed "Tenders for Electric Works, Contract No. ——," and addressed to the Chairman of the Electricity Committee, must be delivered at this office not later than 12 noon THURSDAY, JULY 18th, 1901.

ARTHUR WRIGHT,
Consulting Electrical Engineer.

27, Osborn Street, E. 3585

Official Notices.

BOROUGH OF SOUTHWARK
(PARISH OF ST. MARY, NEWINGTON).

Electricity Supply Extension.

CONTRACT No. 15.

THE ELECTRIC LIGHT COMMITTEE of the Metropolitan Borough of Southwark are desirous of receiving Tenders for the supply and erection of two additional panels to the main switchboard at their electric light station, Penrose Street, Walworth Road, S.E.

Specifications and Forms of Tender can be obtained on and after the 26th instant at the office of the Engineers, Messrs. Kincaid, Waller & Manville, 29, Gt. George Street, Westminster, S.W., on payment of a fee of Five Guineas, which sum will be returned on receipt of a *bona fide* tender.

The Corporation do not bind themselves to accept the lowest or any tender, and the contractor whose tender is accepted shall enter into a formal agreement, under seal, with sufficient sureties, for the due fulfilment of his contract.

Sealed tenders, endorsed "Electricity Supply, Tender for Contract No. 15," to be sent to me on or before noon on the 10th day of JULY, 1901.

By Order,
J. A. JOHNSON,
Town Clerk.

Town Hall, Walworth Road, S.E.
June 25th, 1901. 3596

BOROUGH OF COLNE.

THE TECHNICAL COMMITTEE are prepared to receive Tenders for One 6 B.H.P. Protected Motor, suitable for fixing to a wall, and fitted with countershaft and gearing attached to the case.

Specifications, together with Forms of Tender, and General Conditions, can be obtained from the undersigned on payment of a deposit of 10s., which will be refunded on receipt of a *bonâ fide* tender.

Sealed tenders, to be endorsed "Tender for Motor," and addressed to the Chairman of the Technical Committee, Town Hall, Colne, Lancashire, not later than 10 a.m. JULY 5th, 1901.

The lowest or any tender not necessarily accepted.

A. G. COOPER, A.M.I.E.E.,
Borough Electrical Engineer.

Town Hall, Colne,
June 25th, 1901. 3590

ROYAL BURGH OF KIRKCALDY.

THE CORPORATION invite Tenders for the Supply, Delivery, and Erection of the following work:—

Specification No. 6.—Feeders, Mains, and Roadwork.
Specification No. 7.—Arc Lamps.

Copies of the Specifications and Drawings can be obtained from the undersigned on payment of £3 3s., to be returned on receipt by the Corporation of a *bona fide* tender.

The Specifications and Drawings can be seen at (but not obtained from) the offices of Messrs. Kennedy & Jenkin, 17, Victoria Street, Westminster, S.W.

Tenders must be sent in to the undersigned so as to be received by him before 10 a.m. on JULY 20th.

The Corporation does not bind itself to accept the lowest or any tender, and no allowance whatever will be made for any expense incurred in the preparation of any tender.

WM. L. MACINDOE,
Town Clerk.

Town Clerk's Office,
Kirkcaldy, *June 24th*, 1901. 3594

(Continued on next page.)

Official Notices.—*Continued.*

CLECKHEATON URBAN DISTRICT COUNCIL.

ELECTRICITY WORKS.

THE COUNCIL hereby invite Tenders for the supply and erection of the following plant:—

Section A.—Lancashire Boilers.
Economiser.
Jet Condenser.
Feed Pumps.
Suction Pumps.
,, B.—Meldrum's Destructor Furnaces.
,, D.—Balancers and Boosters.
,, E.—Accumulators.
,, F.—Cables.
,, G.—Switchboards.
,, H.—Travelling Crane.

Tenderers are at liberty to tender for the whole of the Sections, or any one Section, but not for part of a Section.

Conditions and Specifications, with Forms of Tender, may be inspected at the offices of Messrs. Gibbings & Baker, Piccadilly Mansions, 17, Shaftesbury Avenue, London, W., and Old Bank Chambers, Cheapside, Bradford, and may be obtained on application to the Clerk of the Council, Town Hall, Cleckheaton, on payment of the sum of £2 2s., which sum will be refunded on return of Specification with *bona fide* tender.

Tenders, sealed and endorsed "Electricity Works Plant, Section ——," to be delivered at the Clerk's Office, Town Hall, Cleckheaton, on or before JULY 6th, 1901.

Each Tender must contain the names of two sureties, who will be prepared to execute a joint and several bond for the due fulfilment of the contract in a sum of £25 per cent. of the contract sum.

The Council do not bind themselves to accept the lowest or any tender.

J. ARMITAGE,
Clerk of the Council.

Town Hall, Cleckheaton,
June 25th, 1901. 3604

BOROUGH OF SHOREDITCH.

ELECTRICITY SUPPLY.—CONTRACT NO. 28.

THE SHOREDITCH BOROUGH COUNCIL invite Tenders for the supply and erection of the work included in the above Contract for the new Generating Station at Whiston Street, the existing Station at Coronet Street, and the Sub-stations at Reeves Place and Evelyn Street.

HIGH AND LOW TENSION CONTINUOUS CURRENT SWITCHBOARDS AND INSTRUMENTS.

Specifications and Forms of Tender may be obtained on and after July 1st at the Office of the Council's Electrical Engineer, C. Newton Russell, Esq., Electric Light Station, Coronet Street, Hoxton, N., on payment of a fee of Five Guineas, which will be returned on receipt of a *bonâ fide* Tender. A copy of the Specification may also be inspected (but not obtained) at the Offices of the Consulting Engineers, Messrs. Kincaid, Waller, & Manville, 29, Great George Street, Westminster.

The Council do not bind themselves to accept the lowest or any Tender, and the Contractor whose Tender is accepted shall enter into a formal agreement, under seal, with sufficient sureties for the fulfilment of his contract.

Trade union rates of wages and hours to be observed.

Sealed Tenders, endorsed "Electricity Supply—Tender for Contract No. 28," must be forwarded to me before noon on the 10th day of JULY, 1901.

By Order,
H. MANSFIELD ROBINSON,
Town Clerk and Solicitor.

Town Hall,
Old Street, E.C.,
June, 1901. 3620

Official Notices.—*Continued.*

TO ELECTRIC LIGHTING ENGINEERS.

THE COMMITTEE of the Brecon and Radnor Joint Asylum, now building at Talgarth, are prepared to receive Schemes, Specifications and Tenders for the Electric Lighting of the above Asylum.

All information can be obtained from the architects Messrs. Giles, Gough & Trollope, 28, Craven Street, Strand, between the hours of 11 and 1 on payment of Three Guineas, to be returned on receipt of a *bona fide* Scheme, Specification and Tender. Plans of the buildings will be supplied by the architects on payment of cost of preparation.

Schemes, Specifications and Tenders are to be delivered, endorsed "Tender for Electric Lighting," and addressed to the Clerk to the Visiting Committee, County Hall, Brecon, not later than AUGUST 5th next.

The Committee do not bind themselves to accept the lowest or any Tender, Scheme, or Specification. 3570

GLASGOW CORPORATION.

ELECTRICITY DEPARTMENT.

THE CORPORATION OF GLASGOW invite Tenders for the supply of Concentric and Single Main Cables, insulated with paper or fibre impregnated with oil, bitumen, or other substance impervious to moisture, or with vulcanised bitumen. Copies of Specification, with Form of Tender, may be had on application to Mr. W. A. CHAMEN, the engineer, 75, Waterloo Street, Glasgow, upon payment of Two Guineas, which will be returned on receipt of a *bona fide* Tender, and offers marked "Tender for Cables, Electricity Department," must be lodged with the subscriber on or before TUESDAY, 9th JULY, at 10 a.m.

The Corporation do not bind themselves to accept the lowest or any offer.

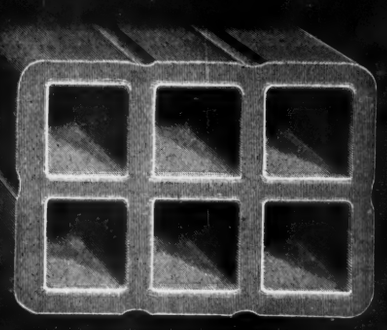
J. D. MARWICK,
Town Clerk.

City Chambers, Glasgow.
June 26th, 1901. 3643

EVERSHED & VIGNOLES, Ltd.,
MAKERS OF ALL KINDS OF
ELECTRICAL INSTRUMENTS.
See Advertisement June 7th. 3774

BELLISS & MORCOM LTD.
(Successors to C. H. Belliss & Co., Ltd.),
BIRMINGHAM.
PATENT SELF-LUBRICATING ENGINES
FOR ELECTRIC LIGHT, POWER OR TRACTION.
See Illustrated advertisements Alternate Weeks.

RUBELLITE.
An IMPROVED and Most Perfect kind of Vulcanite or Ebonite specially prepared for Electrical Purposes.
O. BEREND & CO., Ltd., BASINGHALL AVENUE, LONDON, E.C. 3674

Doulton Conduits
For Underground Cables.

DOULTON & CO., LIMITED,
LAMBETH, LONDON, S.E.

ECONOMY

IN

ELECTRICITY SUPPLY.

THE MOST RELIABLE

STORAGE BATTERY

Worked under the ONLY

PERFECT SYSTEM

Of Regulation.

Full details and Prices of above on receipt of Particulars of the work the battery is required for.

THE CHLORIDE ELECTRICAL STORAGE SYNDICATE, Ltd.,

CLIFTON JUNCTION,
Near MANCHESTER.

London Office:
39, VICTORIA STREET, S.W.

This Prospectus has been filed with the Registrar of Joint Stock Companies.

The Subscription List will open on Tuesday, the 25th day of June, 1901, and will close on or before Saturday, the 29th day of June, 1901.

The Urban Electric Supply Co., Ltd.,

Incorporated under the Companies Acts, 1862 to 1893.

SHARE CAPITAL - - - - - - - - - £500,000,

Divided into	50,000 5 per cent. Cumulative Preference Shares of £5 each - - - - -	£250,000
	50,000 Ordinary Shares of £5 each - - - - - - - - - -	£250,000
	Of which 4,000 Ordinary Shares have already been subscribed for by and allotted to Edmundson's Electricity Corporation, Limited.	£500,000

A dividend of 5% on the Preference Shares and a minimum dividend of 5% on the Ordinary Shares has been guaranteed until Dec. 31, 1910, by Edmundson's Electricity Corporation, Ltd., the terms of the guarantee being contained in the Contract within mentioned.

30,000 5 per cent. Cumulative Preference Shares of £5 each and 30,000 Ordinary Shares of £5 each,

Are now offered for Subscription at par, payable as follows:—10s. per share on Application, 10s. per share on Allotment, and the remainder in calls of not more than £1 at intervals of not less than three months.

Any Subscriber may, if he so desire, pay up the balance of £4 on or after allotment, receiving interest thereon at the rate of 4 per cent. per annum. Holders of Preference Shares are entitled to a fixed cumulative Preferential Dividend of 5 per cent. per annum, and the shares are also preferential as to capital. The guaranteed dividends on both Preference and Ordinary Shares are payable half-yearly on 1st April and 1st October, the first payment to be made on 1st October, 1901. Dividends will be calculated on the amounts called up.

Directors.

FRANCIS EDWARD GRIPPER, M.I.E.E. (Managing Director Edmundson's Electricity Corporation, Limited), Clifton Villa, St. Margaret's-on-Thames, *Chairman*.

EDMUND CHARRINGTON, A.M.I.C.E., Mayfield, Chislehurst, Engineer.

HERBERT BRENT GROTRIAN, Hare Court, Temple, E.C., Barrister-at-Law.

WILLIAM PAGE (Director of the Brompton and Kensington Electricity Supply Company, Limited), Rickmansworth.

JOAN CUTHBERT WIGHAM (Director Woolwich District Electric Light Company, Limited), Coanwood, Surbiton.

Solicitors.

LINKLATER, ADDISON, BROWN & JONES, 2, Bond Court, Wallbrook, London, E.C.

Brokers.

COATES, SON & CO., 99, Gresham Street, London, E.C.

FENN & CROSTHWAITE, 44, Coleman Street, London, E.C.

Bankers.

LONDON AND WESTMINSTER BANK, LIMITED, Lothbury, London, E.C.

Consulting Electrical Engineer.

F. HASTINGS MEDHURST, M.I.E.E. (F. H. Medhurst & Lloyd), 13, Victoria Street, Westminster, S.W.

Auditors.

JOHN ANNAN, DEXTER & CO., 11, Ironmonger Lane, E.C.

Secretary and Offices.

C. H. JONES, Broad Sanctuary Chambers, Westminster, S.W.

PROSPECTUS.

This Company was formed in 1898 for the purpose of obtaining Parliamentary powers to work electric light and tramway undertakings in various places in England and Scotland.

Town.	First complete year's working. Year.	Capital expended (averaged over the year).	Profit per cent.	Second complete year's working. Year.	Capital expended (averaged over the year).	Profit per cent.	8 c/p Lamps (equivalents) connected. Jan. 1st, 1899.	Jan. 1st, 1900.	Jan. 1st, 1901.
Folkestone	1899	£52,267	4¼	1900	£69,059	4¼	10,089	17,834	24,181
Woolwich (reconstructed)	1899	25,880	4½	1900	41,772	6¾	4,810	9,610	19,425
Winchester	1899	25,404	2½	1900	32,284	4¾	3,815	10,043	15,126
Bromley (Kent)	1899	34,000	3¼	1900	50,045	4	2,308	7,377	13,395
Wycombe	1899	28,694	3½	1900	41,115	5¼	1,746	7,686	16,910
Salisbury	1899	25,707	2½	1900	30,866	5	2,157	6,228	9,795
Newmarket	1900	23,881	2	—	—	—	—	4,679	6,982
Ventnor	1900	31,366	3½	—	—	—	—	3,730	7,199
Chislehurst	1900	17,891	1½	—	—	—	—	4,617	4,987

Powers have now been acquired for the following towns and districts either by this Company or by others acting under its control:—

	Estimated Population	Estimated amount now required for works.
ELECTRIC LIGHTING.—		
Camborne and Redruth	£26,000	£35,000
Glossop	23,000	27,000
Twickenham	20,000	26,000
Hawick	19,000	16,000
Grantham	17,000	17,000
Berwick-on-Tweed	14,000	14,000
Bishop Auckland	11,000	15,000
Godalming	11,000	14,000
Newton Abbot	9,000	15,000
Stamford	9,000	15,000
Dartmouth	6,000	15,000
Weybridge	4,000	16,000
ELECTRIC TRAMWAYS—		
Camborne and Redruth (3¼ miles)		£40,000
*Glossop (4½ miles)		50,000
		£315,000

* The Provisional Order for the Tramways at Glossop has been granted by the Board of Trade with the sanction and support of the Corporation of Glossop, and only awaits the usual confirmation by Act of Parliament.

Mr. F. H. Medhurst, who will act as the Consulting Engineer of this Company, and under whose supervision the works are to be carried out, has made a Report, of which copy is enclosed.

The construction of the works will be undertaken by Edmundson's Electricity Corporation, Limited, who have had a large and most successful experience in the erection and working of electricity supply stations in the smaller towns of this country. They have entered into the undermentioned Contract which provides (*inter alia*) for their profit being fixed by the Consulting Engineer of the Company, or in case of difference by arbitration. They also undertake the supervision and general management of the various works until December 31st, 1910, and being satisfied as to the value of the concessions acquired by this Company, and the remunerative character of the works to be carried out thereunder, they have, as part of the terms of the contract, agreed to guarantee for a period of about 10 years, viz.—to December 31st, 1910, the dividend of 5 per cent. per annum on the Preference Shares and Dividends of not less than 5 per cent. per annum on the Ordinary Shares. Inasmuch as it is during the early years that the profits on electricity supply undertakings are small it may reasonably be expected that the dividends on the Ordinary Shares will exceed the minimum long before the expiry of the guarantee period.

The net assets of Edmundson's Electricity Corporation, after deducting Debenture debt, and exclusive of goodwill, were on the date of the last issued balance sheet of March 31st, 1900, upwards of £164,000, since which date £100,000 additional has been paid up on Preference shares. The net profits for the year ended March 31st, 1900, after payment of Debenture interest, were £17,200. Dividends of 6 per cent. per annum on the Ordinary Share Capital have been paid since its incorporation.

Stations erected by Edmundson's Electricity Corporation, Limited, in the undermentioned towns have been running for one or more completed years, and with the exception of Folkestone, are still managed by them. By the exercise of economical management and energy in obtaining lamp connections the working of these stations has resulted in a profit even in the first year's working, and similarly successful results should accrue from their management of the stations belonging to this Company. The following Table has been furnished by them:—

The Clauses in the Articles as to remuneration of Directors are as follows:—

97. The Directors exclusive of the Managing Director, shall be entitled to receive by way of remuneration in each year £1,000, and in addition £400 in every year in which a dividend at the rate of at least 6 per cent. per annum shall be paid on the ordinary share capital of the company for the time being paid up, together with 10 per cent. of the net profits of the Company remaining in that year after payment to the Ordinary Shareholders of a dividend of 6 per cent. on the amounts paid on their shares, but the total remuneration shall not in any one year exceed £2,000. Such remuneration shall be divided among the Directors in such proportions and manner as they shall from time to time agree, or in default of agreement, equally. The Company in General Meeting may increase the amount of such remuneration, either permanently, or for a year or longer term.

113. The remuneration of a Managing Director or of a Committee of Management shall from time to time be fixed by the Directors, and may be either by fixed salary or by a commission or percentage on profits, or partly by one and partly by the other, as the Directors may determine.

The qualification of Directors is fixed by the Articles of Association to be the holding of Shares of the nominal value of £250 at the least.

A Contract dated 21st June, 1901, has been entered into between Edmundson's Electricity Corporation, Limited, and this Company for carrying out the electric lighting and tramway works in the different towns above-mentioned. The Contract includes a sum of £15,000, being 5 per cent. on the capital now offered for subscription, which is to be paid to the Contractors, and for which sum they have undertaken to subscribe or procure the subscription of the whole of the capital now offered. Under the contract all the preliminary expenses up to allotment are to be borne by the Company. Other Contracts entered into are referred to in the list which accompanies this Prospectus, and which is to be deemed to form part thereof.

Mr. Francis Edward Gripper is interested as being a Director of, and the holder of 998 shares in, Edmundson's Electricity Corporation, Limited, and as an Underwriter of 140 shares of this issue. Mr. John Cuthbert Wigham is interested as being the holder of 202 shares in Edmundson's Electricity Corporation, Limited, and as an Underwriter of 200 shares, Mr. Page is an Underwriter of 200 shares, and Mr. Charrington is an Underwriter of 1,000 shares.

Edmundson's Electricity Corporation, Limited, having undertaken to subscribe or procure subscriptions for the whole of the capital now offered, the Directors will proceed to allotment on the closing of the list.

Copies of the Memorandum and Articles of Association and of all the abovementioned Contracts, also of the various Electric Lighting Orders and Deeds of Transfer, and the original Report of the Consulting Engineer of the Company, can be inspected at the Offices of the Company during business hours.

It is intended to apply, in due course, for a settlement and quotation on the Stock Exchange.

Applications for Shares should be made on the accompanying form, and forwarded to the Bankers of the Company, the London and Westminster Bank, Limited, Lothbury, E.C., together with a remittance for the amount of the deposit.

If the whole number of Shares applied for be not allotted, any surplus amount paid as deposit will be appropriated towards the sum due on allotment. Where no allotment is made the deposit will be returned in full.

Prospectuses and Forms of Application for Shares may be obtained at the Offices of the Company, or from the Bankers or Brokers.

Dated 21*st June*, 1901.

IMPERIAL ELECTRIC SUPPLIES, Limited.

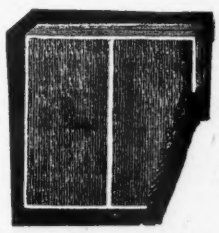
High Grade Incandescent Lamps.

SWITCHES, CUT-OUTS, AND Electrical Accessories.

SEND FOR PAMPHLET GIVING FULL PARTICULARS.

86, CHARING CROSS ROAD, W.C.

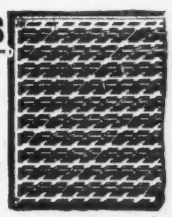
Telep. 2486, GERRARD.



Accumulators

Stationary AND ***Traction.***

HIGHEST EFFICIENCY and DURABILITY.



Positive Plate of STATIONARY or HEAVY TRACTION Accumulator. Grids "Franke System." Negative Plate of STATIONARY or HEAVY TRACTION Accumulator.

LIGHT TRACTION ACCUMULATORS for ELECTRIC AUTOMOBILES and LAUNCHES, &c.

Thoroughly consistent with regard to DURABILITY and Conditions of Constant Work.

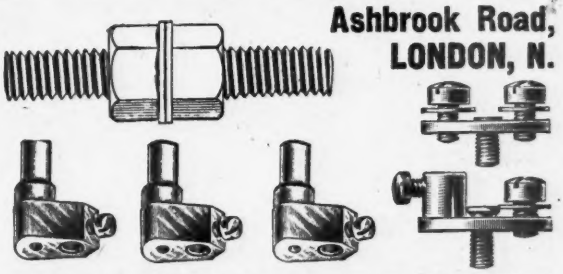
ELECTRIC VEHICLES BUILT TO SPECIFICATION—ANY MAKE ELECTRIC CAR EQUIPPED with ACCUMULATORS, MOTORS, &c.

Accumulator Machinery and Components:—CAST GRIDS—FORMED PLATES—CASTING, SMEARING and MIXING MACHINES (System "Franke")—EBONITE ACCUMULATOR BOXES—ACID-PROOF and INSULATING PAINTS and VARNISHES.

ACCUMULATOR INDUSTRIES, LTD., *14, Silver St., Bloomsbury, W.C.* WORKS: WOKING, SURREY.

ROSS COURTNEY & Co., Ltd.

Ashbrook Road, LONDON, N.



TERMINALS, SCREWS

SMALL TURNED PARTS, STAMPINGS, &c.,

MADE TO ORDER.

Quotations on Receipt of Requirements.

DYNAMOS & MOTORS.

Multipolar Type from 1 to 200 H P.
TWO-POLE MACHINERY to order.
SLOW SPEED MOTORS for direct driving.

SPECIALITY.—High Voltage Enclosed Motors.

MANUFACTURED BY

WHITE, JACOBY & CO., Ltd.,

BAYHAM PLACE, LONDON, N.W.

Telegrams: "SATURATION, LONDON." Telephone 712 King's Cross.

THE

EDISON & SWAN CO.

REPRESENT THE

ORIGINAL INVENTORS, PATENTEES, and FOUNDERS

OF THE

INCANDESCENT LAMP INDUSTRY.

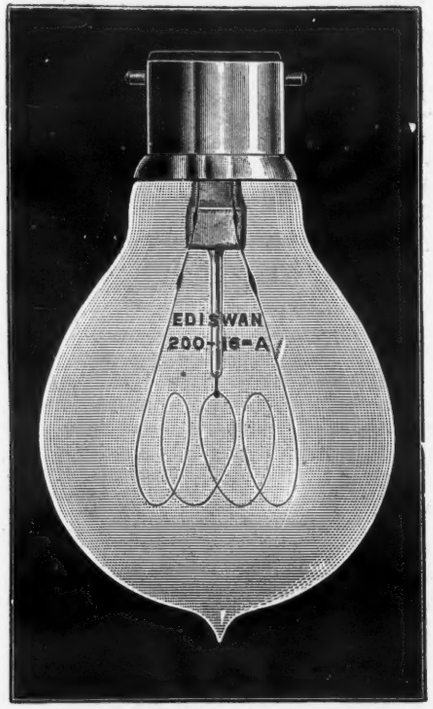
STANDARD LAMP, 16 C.P., 100 VOLTS. FULL SIZE.

The WORLD-RENOWNED

EDISWAN LAMPS

are the

BEST AND CHEAPEST IN THE END.



HIGH VOLTAGE LAMP, 16 C.P., 200 VOLTS. FULL SIZE.

THE EDISON & SWAN UNITED ELECTRIC LIGHT COMPANY, LIMITED,

Head Office, Warehouse and Showrooms:—EDISWAN BUILDINGS, QUEEN STREET, LONDON, E.C.

EDISWAN

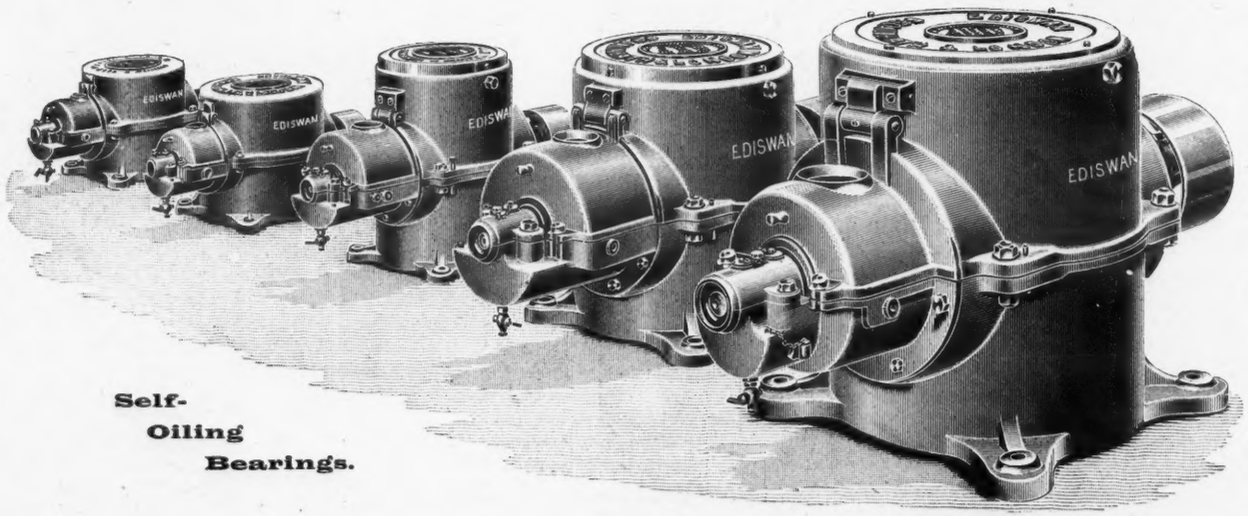
EDISWAN COMPLETELY ENCLOSED MOTOR

The Most Efficient Motor on the Market.

ENTIRELY ENCLOSED IN CAST STEEL CASE.

Capable of standing per **20** cent. Overload for considerable periods without injury.

All Connections fully accessible on opening the Commutator Box.



Self-Oiling Bearings.

Thoroughly Reliable under any Atmospheric Conditions.

Carbon Brushes can be replaced whilst Running, and do not require adjustment for change in direction or change of load.

THE HIGH EFFICIENCY OF THIS MOTOR ENSURES A MONETARY SAVING ON THE YEAR'S RUNNING.

Estimates Free. **Write for Illustrated Leaflet.**

THE EDISON & SWAN UNITED ELECTRIC LIGHT COMPANY, LIMITED,

Head Office, Warehouse and Showrooms:—EDISWAN BUILDINGS, QUEEN STREET, LONDON, E.C.

Supply Store:—COLLEGE HILL, E.C. LARGE STOCKS OF FITTINGS, BELLS AND ALL ELECTRICAL ACCESSORIES READY FOR DELIVERY.

Works—PONDER'S END, MIDDLESEX; BROADHEATH, MANCHESTER; SELBORNE WORKS, WALSALL; SOUTH BENWELL, NEWCASTLE-ON-TYNE

Branches and Agencies throughout the United Kingdom and in every part of the World.

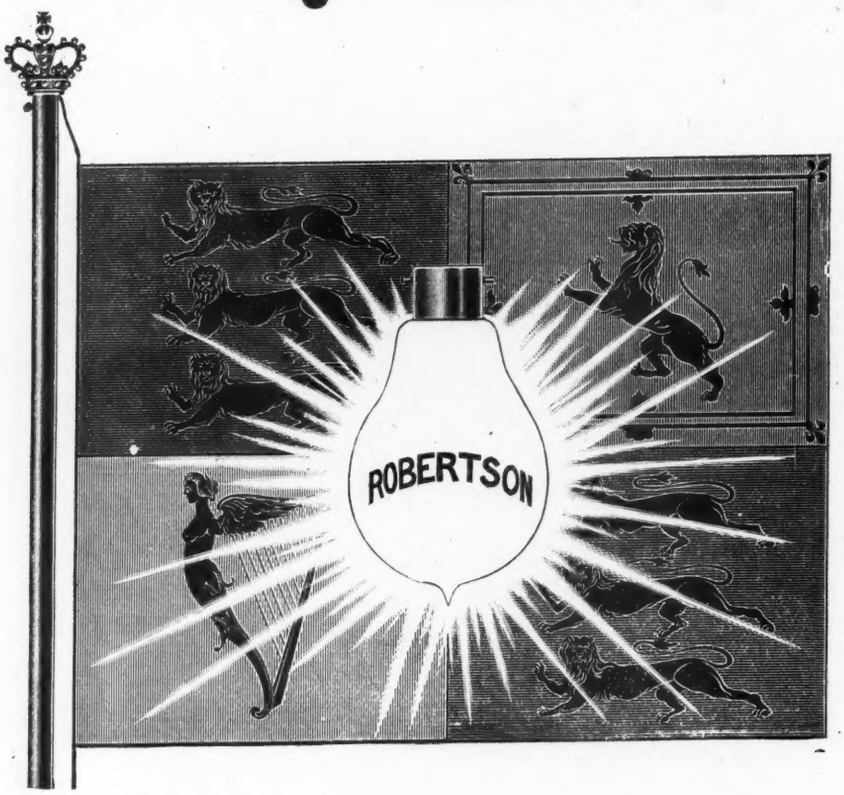
LAMPS.

Head Office, Warehouse and Showrooms:—EDISWAN BUILDINGS, QUEEN STREET, LONDON, E.C.

THE EDISON & SWAN UNITED ELECTRIC LIGHT COMPANY, LIMITED,

THE STANDARD
OF QUALITY.

LONG LIFE.



SAVES CURRENT.

BRITISH MADE.

OUR HIGH-VOLTAGE LAMP IS RECOGNISED BY CENTRAL STATION ENGINEERS AS THE MOST EFFICIENT.

SOLE SELLING AGENTS:—

THE GENERAL ELECTRIC CO. (1900), Ltd.,

Head Offices, Warehouses, and Showrooms :

69, 71, 88, & 92, Queen Victoria Street, LONDON, E.C.

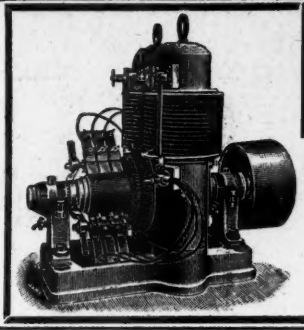
TRADE MARK

BRANCHES : Victoria Bridge, MANCHESTER. 71, Waterloo Street, GLASGOW. 56, Barwick Street, BIRMINGHAM. 13, Westgate Road, NEWCASTLE-ON-TYNE. 16, St. Andrew Street, DUBLIN. East Wharf, St. Mary St., CARDIFF.

WORKS : Peel Works, Adelphi, SALFORD. Sherlock Street, BIRMINGHAM. Brook Green, HAMMERSMITH. Union Street, SOUTHWARK. CLERKENWELL.

REG° TRADE MARK

Agents for the Commonwealth of Australia and New Zealand : LAWRENCE & HANSON, 3, Wynyard St., SYDNEY, and 167, Queen St., MELBOURNE.



THE "CASTLE" SLOW SPEED.

HIGH EFFICIENCY.

J. H. HOLMES & CO.

NEWCASTLE-ON-TYNE,

AND

17, SOHO SQUARE, LONDON, W.

DYNAMO

TELEPHONE No. 5,077, Bank. Telegram: "INDICES," LONDON.

WHEATLEY KIRK, PRICE & CO.

(ESTABLISHED 1860),

Electrical Auctioneers, Valuers,

AND ARBITRATORS.

Average Annual Valuations exceed £2,000,000 sterling.

46, WATLING STREET, QUEEN VICTORIA ST., LONDON, E.C.

AND

ALBERT CHAMBERS, ALBERT SQUARE, MANCHESTER.

Telegraphic Address:—"Indicator, Manchester." Telephone No. 3213. 3193

TO ENGINEERS, TOOL-MAKERS, ELECTRICIANS, DEALERS, BROKERS AND OTHERS.

WHEATLEY KIRK, PRICE & CO.

Have received instructions from Messrs. The Edison & Swan United Electric Light Company, Limited, to

SELL BY PUBLIC AUCTION,

On TUESDAY the 9th and WEDNESDAY the 10th JULY, 1901, upon their premises known as The Broadheath Engineering Works, Broadheath, near Manchester, on account of Removal to Ponder's End, London,

The PLANT & MACHINERY, comprising:—50-H.P. Enclosed Vertical Steam Engine, by Browett, Lindley & Co., Ltd.; 8-H.P. Portable Engine by Clayton and Shuttleworth; 30 KW. Alternator by Edison & Swan; 2 Self-contained Drilling Machines; several Slide, Surfacing and Screw-cutting Lathes by Muir, Pitts, Carter, Sons & Co., and Greenwood & Batley; Planing Machine to plane 18 ft. by 6 ft. by 5 ft. 6 in. high; Vertical and Horizontal Milling Machines; 6 Screw Fly Presses; Screwing Machines; Lathe Beds, &c., &c.

FINISHED and UNFINISHED STOCK, comprising:—One 42 KW., Two 66 KW., Four 3 to 7 KW., Six 2 to 25 KW., Seven 2 to 13 KW. Dynamos; 140 Enclosed Motors from ¼ to 30 H.P.; Transformers; several gross Single and Double-Pole Switches, Terminals, Fuses, Handles, Bases and Brush Boxes; Armatures, Commutators, Scrap Brass, Copper, and German Silver; Loose Tools, Shafting, Pulleys, Timber Sheds, Scrap Wrought Iron, Cast-iron and Brass, and other effects.

May be viewed day preceding and morning of sale.

For further particulars apply to the AUCTIONEERS, Albert Chambers, Albert Square, Manchester, and 46, Watling Street, London, E.C.

Telegrams:—"Indicator, Manchester." "Indices, London."

Telephone No. 3218, Central, Manchester. 5077 Bank, London." 3587

Educational Notice.

UNIVERSITY COLLEGE OF NORTH WALES, BANGOR.

ELECTRICAL ENGINEERING DEPARTMENT.

Professor of Physics:—*E. TAYLOR JONES, D.Sc.*

Drapers' Company's Assistant Lecturer and Demonstrator in Electrical Engineering:—*W. W. FIRTH, M.Sc.*, late Whitworth Exhibitioner.

IN OCTOBER next a systematic COURSE OF INSTRUCTION IN ELECTRICAL MEASUREMENT AND PRACTICAL ELECTRICITY for students proposing to enter the profession of ELECTRICAL ENGINEER will be commenced. The Physical Laboratory is fully equipped with a Compound Steam Engine, Dynamos, Transformers, Secondary Battery and the most approved modern Measuring Instruments for all branches of electrical engineering.

The Fee for the Course will in ordinary cases be £14 4s. per Session. Average cost of living at Bangor for the Session (33 weeks), £20 to £30. The Course extends over two sessions.

Applications for Calendar, Prospectus, and general information, to be made to

J. E. LLOYD, M.A.,
Secretary and Registrar. 3397

SITUATIONS VACANT.

DEVONPORT CORPORATION ELECTRICITY WORKS.

Switchboard Attendant.

SWITCHBOARD Attendant, wanted in a combined lighting and traction station, must have had practical experience in continuous current station, three-wire system with batteries. Applications stating age, experience, and salary required, with copies of not more than three testimonials, to be sent to Mr. C. FURNESS, Borough Electrical Engineer, Electricity Works, East Stonehouse, Devon, endorsed "Switchboard Attendant." 3366

SITUATIONS VACANT.—*Continued.*

COUNTY BOROUGH OF BOLTON TECHNICAL SCHOOL.

WANTED.—An Assistant Teacher of Electrical Engineering. Commencing salary £120 per annum.

Full particulars can be obtained by sending a fully addressed envelope to the undersigned. Applications will be received up to JUNE 30th, 1901.

F. WILKINSON,
Director.

Technical Schools, Bolton. 3417

HULL MUNICIPAL TECHNICAL SCHOOL.

A LECTURER and Demonstrator in Electrical Engineering will be required in September next. Salary £150 per annum.—Forms of application and further information may be obtained from Dr. J. T. RILEY, Technical School, Hull. 3427

STEPNEY BOROUGH COUNCIL.

Electricity Department.

APPLICATIONS are invited for the following posts:—

ENGINEER-IN-CHARGE OF STATION.—Must have had thorough mechanical and electrical training, and have had previous charge of plant consisting of water-tube boilers, high speed engines, direct current dynamos, &c.

METER AND GENERAL TESTING SUPERINTENDENT.—Must have had at least three years' experience in meter testing and be acquainted with the testing and connecting of house services and general routine of central station testing and meter department.

METER ROOM ASSISTANT.—Must have had experience in meter and general testing and be acquainted with routine of meter department.

Applications in writing, stating age, experience and salary required, accompanied by copies of not more than three recent testimonials, must be sent to the undersigned not later than MONDAY, JULY 8th.

WM. C. P. TAPPER,
Engineer and Manager,
27, Osborn Street, E. 3412

THE COMMITTEE of the Municipal School of Technology, Manchester, to be opened in September next, invite applications from gentlemen qualified to take the position of Head of the Physics and Electrical Engineering Department. Stipend £500 per annum.

The gentleman appointed will have the title of professor and rank as a member of the Board of Studies. He will have the assistance of an efficient staff.

Acceptable candidates, in addition to satisfactory theoretical attainments, must have had an efficient training and experience in some important branch of practical electrical engineering.

Applications, with copies of a limited number of recent testimonials, should be addressed not later than SATURDAY, JULY 6th, to the undersigned, from whom further information as to the conditions of the appointment may be obtained.

J. H. REYNOLDS,
Principal.

Princess Street,
Manchester,
June 17th, 1901. 3340

WANTED by the Ealing District Council, a Gentleman to act as Clerk to the Electric Lighting Committee. Must have had experience in a similar capacity, preferably with a corporation. He must be fully qualified to take full control of the accounts, and the commercial department of the electric lighting undertaking, prepare the necessary cost sheets, balance sheets, &c., and canvass for new business.—Apply with full particulars of experience, age, and salary required to The CHAIRMAN, Electric Lighting Committee, Public Buildings, Ealing. Envelope to be endorsed "Clerk." 3362

CANVASSER required in Ilford to call upon tradesmen and residents in regard to electric lighting, to give information and answer enquiries. Must have had previous experience. May also be required to read meters when necessary. Salary £2 per week. Applications, stating age and experience, and marked "Canvasser," must be delivered to Mr. W. J. WOODWARD, Electrical Engineer, at 7, Cranbrook Road, Ilford, not later than Wednesday, July 3rd, 1901. 3406

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

ELECTRICAL ENGINEER (TRAMWAYS).

WANTED IMMEDIATELY, by the Council of the City of Wellington, New Zealand, a thoroughly qualified Electrical Engineer, who must have had special experience in carrying out and equipping overhead electrical tramways and power stations. Full particulars and conditions may be obtained on application to Messrs. JOHN DUTHIE & Co., LTD., 23, Lime Street, London, E.C., to whom endorsed applications must be delivered not later than noon on the 20th July. 3494

COUNTY BOROUGH OF HUDDERSFIELD.

Electric Tramways.

THE TRAMWAYS COMMITTEE OF THE CORPORATION invite applications for the post of Shift Engineer at their power station. Salary £100 per annum.

An Engine Driver is also wanted. Preference will be given to applicants with previous experience of Corliss engines of large size. Wages 5s. 10d. per nine hours shift.

Further particulars as to duties and qualifications may be obtained on application to the Tramways Electrical Engineer, Power Station, Longroyd Bridge.

Applications, stating age and experience, and accompanied by copies of not more than three recent testimonials (which will not be returned) and endorsed "Engineer" or "Driver" as the case may be, must be delivered to the Town Clerk, Town Hall, Huddersfield, not later than JULY 1st, 1901.

By Order,
F. C. LLOYD,
Town Clerk.

Town Hall,
June 19th, 1901. 3540

BOROUGH OF WALSALL.

Electricity Department.

WANTED.—An experienced Fitter to take charge of running machinery at the generating station during one shift. Electrical experience essential. Wages £2 per week increasing to £2 5s.

Applications, stating age and experience, and enclosing copies two recent testimonials, to be sent to the undersigned not later than TUESDAY, JULY 2nd.

(Signed) ALEXR. WYLLIE,
Borough Electrical Engineer. 3513

CROYDON COUNTY POLYTECHNIC, CROYDON.

Department of Electrical Engineering.

THE COMMITTEE require the services of an Assistant Lecturer and Demonstrator in this department. The person appointed will be required to attend on three evenings each week and must be qualified to lecture in at least one branch of electrical engineering.

Salary £50 for the Session of about 30 weeks.

Applications, with copies of testimonials, must be sent to the undersigned, from whom further particulars of the appointment may be obtained, not later than WEDNESDAY, JULY 10th, 1901.

S. W. BICKELL,
Secretary.

June 24th, 1901. 3597

COUNTY BOROUGH OF SWANSEA.

Resident Electrical Engineer.

THE CORPORATION OF SWANSEA invite applications for the appointment of Resident Electrical Engineer to take charge of their Electricity Works.

Applicants must have had experience in the management of a central electrical supply station.

Forms of application can be obtained from the Town Clerk, Swansea, to whom applications, accompanied by copies of not more than three testimonials of recent date, must be sent not later than Thursday, the 11th day of July.

JNO. THOMAS,
Town Clerk.

Guildhall, Swansea,
June 25th, 1901. 3616

ELECTRICAL FITTER wanted at once at the Grove Fever Hospital, Tooting Grove, Tooting Graveney, S.W. (under the Metropolitan Asylums Board). Applicants must be accustomed to electric light engines and dynamos and have a fair knowledge of concentric wiring, earthed outer telephones and bells.

Wages 30s. per week, with board, lodging, washing, and overalls (subject to statutory deductions under the Poor Law Officers' Superannuation Act, 1896). The selected candidate will be required to pass a medical examination prior to appointment.

Application to be made on Forms obtainable from the Clerk, Metropolitan Asylums Board, Embankment, E.C., are to be sent to the engineer to the Board at the same address by 10 a.m. on THURSDAY, JULY 4th.

June 26th, 1901. 3637

SITUATIONS VACANT.—*Continued.*

CORPORATION ELECTRIC TRAMWAYS.

Wanted.

SWITCHBOARD ATTENDANTS for extra high tension substation operating electric tramways. Previous experience in charge of high tension switchboards essential.

Applications, giving details as to age, previous experience and present salary, to be sent to No. 3499, ELECTRICAL REVIEW, 4, Ludgate Hill, London, not later than JULY 4th, 1901. 3499

APPRENTICE, Electrical Engineering.—Fabbro & Co., 79, High Street, Battersea, established for many years, have a vacancy for an apprentice: premium required.—Apply by letter for terms, &c., above address. 3618

ARMATURE Winders.—Several good Armature Winders wanted immediately, used to slotted drum armatures former winding.—Apply, stating age, experience and wage expected to The SUNDERLAND FORGE AND ENGINEERING COMPANY, LTD, Pallion, Sunderland. 3492

ASSISTANT required in estimating department of a large firm near London. Previous experience and knowledge of traction, lighting, and power transmission by direct and polyphase currents essential.—Apply stating age, experience and salary required to No. 3635, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3635

ASSISTANT wanted on the engineer's staff of the London Electric Supply Corporation. Must have had a thorough training. Also previous experience of electrical distribution.—Apply stating age and experience, with copies of testimonials, to RESIDENT ENGINEER, 25A, Cockspur Street, London. 3608

DRAUGHTSMAN, First-class, wanted for electrical works, must have practical experience and be well up in high-tension switchboards and fittings, &c.—Apply by letter stating experience and salary required to 3598, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3598

DRAUGHTSMAN wanted in Manchester accustomed to shop work and mechanical arrangement of motor driving.—Apply, stating experience and terms, 3574, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3574

ELECTRIC Lighting Company in the provinces requires the services of an Experienced Clerk who can attend to all correspondence, interview consumers, collect accounts, and generally attend to the general business of the company.—State full particulars of past experience, age, and salary expected, to "P. W. D.," Donington House, Norfolk Street, Strand, W.C. 3609

ELECTRICAL Engineer required for India.—A capable gentleman with a thorough knowledge of electrical engineering, and preferably with a knowledge of the Indian market, to travel and report upon the prospects of business in that country, and eventually to have charge of the agency of a large manufacturing company. Only gentlemen of ability and experience need apply.—Box 3557, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3557

FOREMAN wanted, thoroughly experienced man for overhead electric tramway equipment.—Reply, stating experience and wages required, with copies of recent testimonials, to Box No. 3638, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3638

MANAGER required for an electrical lift crane works in London. Had large practical experience in works of electrical lifts; first class man required. Good salary will be paid for a really competent man.—State age, full particulars, salary required, in first instance, to "ELECTRICAL," c/o Dixon's Advertising Offices, 195, Oxford Street, W. 3558

PREMIUM Pupil.—An Electrical and Mechanical Engineer, with offices in Manchester, has vacancy for Pupil, one leaving school preferred.—Apply, 3585, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3585

SECRETARY wanted for an electric tramway company, must be young and energetic. Previous experience in tramway work desirable but not indispensable.—State full particulars, age, and salary required to "P. W. D.," Donington House, Norfolk Street, Strand, W.C. 3610

SPECIAL opportunity to learn traction and multiphase work, also latest transmission of power practice, &c. Premium £150 for two years, part in London office and part in large continental works; position on staff at end of pupilage.—Apply, 3573, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3573

TRAVELLER.—Wanted smart energetic man with good connection, for sale of continuous current motors in North of England. Applications must state age, experience, salary required, and when at liberty.—ELECTROMOTORS, LIMITED, Openshaw, Manchester. 3534

TRAVELLERS wanted, to sell high-class electric motors in the United Kingdom. High commission to good men.—Apply 3497, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3497

WANTED.—Thoroughly competent Draughtsman, well up in getting out quantities for and designing lighting and power installations, high speed engines, &c., by a firm of electrical and general engineers.—State fully experience, age and wages required, to "J. H. D.," 70, Attercliffe Road, Sheffield. 3488

WANTED.—Young Draughtsman, competent, used to large switchboard work.—State experience, age, and salary required, Box 3562, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3562

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

WANTED.—Improver or Junior Assistant for Laboratory.—Send full particulars to "P. S. C.," c/o Street's Agency, 30, Cornhill, London. 3614

WANTED at once, by a small firm of London electricians, an Assistant used to installation work.—Apply stating age, 3613, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3613

WANTED.—An Electrical Improver, just out of apprenticeship. Wages 18s. per week.—Apply DIGBY COLLIERY COMPANY, LTD., near Nottingham. 3566

WANTED.—A First-class Traveller with good connection in lamps and accessories amongst station engineers, &c., in the Southern and Eastern Counties.—Apply, giving references, salary required, experience, &c., Box 3589, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3589

WANTED, at once, an Electrical Engineer to make specifications and estimate for installations and wiring in a small first-class business.—Apply by letter only, stating salary required, to "G. B.," 38, North Row, W. 3591

WANTED in estimating office of large London firm, an Engineer with thorough knowledge of traction material. One with further experience in polyphase working preferred.—3605, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3605

WANTED.—A good handy man for a small steam plant and accumulator in Hertfordshire, who would do rough carpentry, painting, glazing, &c., to fill up time. Married. Age about 25 to 30. Must have done similar work with charge of boilers. Wages 28s., with cottage.—Apply Box 3600, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3600

YOUNG Man of practical commercial experience wanted to take charge of West End branch for the supply of electrical accessories. Liberal encouragement will be given to the right man. Apply stating salary, &c.—Box 3597, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3592

SITUATIONS WANTED.

ELECTRO-TECHNICIAN, German, high school, eight years' practical experience, also machinist, mounter, mounting foreman, projector, &c., linguist, desires engagement.

Please address "A. J., 37,162," care of D. Trenz, Mainz, Germany. 3487

ADVERTISER, with degree in engineering, wants to gain shop experience with view to go in for electric traction. Well up in theory and designing. Premium, if any, must be small.—3594, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3594

ADVERTISER (25) seeks re-engagement as Electric Motor or Dynamo Attendant. Two years' experience.—Reply 3607, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3607

ADVERTISER, with spare time (mornings), requires plant, batteries, and charging to attend to in London.—Box 3569, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3569

ADVERTISER, age 24, with good general business knowledge, desires position as Salesman with electrical fittings firm. Salary nominal. Highest references.—3563, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3563

ADVERTISER (26), full City and Guild's certificate and apprenticeship requires situation as Improver or Assistant in central station (continuous current).—3626, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3626

A YOUNG DRAUGHTSMAN requires situation in electrical firm. Best references, thoroughly experienced in alternating and continuous current systems.—No. 3623, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3623

ELECTRIC Light Wireman wants job. Plant work, bells and telephones.—"A. C.," 65, St. John's Hill, Clapham Junction. 3630

ELECTRICAL Draughtsman requires engagement, used to switchboards, complete designing of plants, motive power, underground.—Apply 3568, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3568

ELECTRICAL Engineer desires engagement, 12 years' thorough experience in erection and designing of lighting and power plants, estimating, quantities. Highest references.—Apply 3567, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3567

ELECTRICAL Engineer (32), thorough practical, technical and commercial experience, desires responsible position. Eight years with leading manufacturing and contracting firm as manager of installation department for light and power. Could take entire charge of branch establishment, or would act as representative to a good company. Machinery preferred.—3572, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3572

ELECTRICAL Engineer seeks situation. Thorough all-round practical experience, design, erecting and running; steam, gas (Town & Dowson), and water-driven plant, continuous and alternating. Well used to motors, accumulators, &c.—Apply Box 3493, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3493

ELECTRICAL Engineer desires appointment. Two years with consulting engineer. Six years in high and low tension stations. Some traction experience.—3538, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3538

SITUATIONS WANTED.—*Continued.*

ELECTRICAL Engineer seeks engagement, good all round man; plant, wiring, estimating. First-class references.—Box No. 3502, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3502

ELECTRICAL Store and Book-keeper, &c.—Young Man (20) seeks re-engagement, preferably L. T. works; experience; also knowledge of switchboard. Highest references.—"J. C. E.," Burleigh House, Harrow, London, N.W. 3581

ELECTRICAL Engineer desires engagement; first-class theoretical knowledge; private plant work preferred; good references. — No. 3552, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3552

ELECTRICIAN, 14 years' practical experience, desires charge of installations, or join firm giving security.—3549, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3549

ELECTRICIAN (Practical) seeks position to inspect or erect installations for light or power.—Address, 3441, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3441

ELECTRICIAN and Assistant require job. Light, bells, telephones, motors, and accumulators, have had charge. Town or country.—"ELECTRICIAN," 348, Coldharbour Lane, Brixton, S.W. 3583

ELECTRICIAN, 13 years' practical experience with well known contractors, used to control of men, estimating and carrying out lighting installations.—3575, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3575

ELECTRICIAN, with 18 years' practical experience, seeks re-engagement, town or country; used to plant work or would take charge of country house plant. First-class references.—No. 3588, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3588

ELECTRICIAN (A.I.E.E.—25) wants post as Assistant or Shift Engineer in central station. 2 years at Finsbury College, 3 years as improver at Messrs. Siemens Bros., 2 years at sea in C.P.R. boats, viz., 1½ years engineer on watch, ½-year electrician, 4 months acted as chief assistant at Dewsbury Corporation, during chief's absence through illness.—"A. C. S.," 157, Church Lane, Charlton, London. 3590

ELECTRICIAN (27), good experience, fitting shop, plant, accumulators, ordinary, and ship lighting, had charge, wants light job. Low money.—79, Churchfield Road, Acton, W. 3611

ELECTRICIAN (25) seeks situation as Wireman; with present firm four years, has carried out installations with insulated steel conduit, Simplex and casing. Highest testimonials.—"A. G. K.," 10, Farmer's Street, Nottinghill Gate. 3642

ENGINEER (Young) wants whole or part charge of electric light or pumping plant, or as Shift Engineer in central station; land and marine experience.—"W. W.," 18, Kensington Place, Campden Hill, W. 3590

ENGLISHMAN (45), had complete charge of central station abroad and installed throughout plants with gas, steam, accumulators, seeks situation as above, or testing of dynamos and motors.—3631, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3631

EXPERIENCED Fitter requires change for permanence. Place of trust would suit, or examiner of work. Well up in arc-lamp testing, open or enclosed, switchboards, running plant, wiring, repairs, bridge work, &c. Energetic, 8½ years' good reference. Moderate salary.—Box 3417, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3417

FIRST-CLASS Wireman wants work.—Apply, 3627, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3627

GENTLEMAN, at present disengaged, requires position in firm of electrical engineers. Good experience.—Box 3641, ELECTRICAL REVIEW 4, Ludgate Hill, London. 3641

GENTLEMAN (aged 26) for eight years Correspondent for one of the largest wholesale concerns in the City, desires re-engagement, or a Private Secretaryship; expert Remington shorthand writer; can report companies' meetings; London preferred. Highest references. Address No. 3466, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3466

INCANDESCENT Lamp Maker requires situation.—Box, 3395, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3395

MANAGER, Head of Department or Chief Clerk, 13 years' experience (practical and commercial) with well known contractors; used to control of men, designing and carrying out installations of all kinds and buying in cheapest markets.—3517, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3517

MANAGING Engineer in large cable works is open to consider a change. Experienced in cable machinery, labour-saving tools, making and laying electrical apparatus and mains.—3437, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3437

NOTICE.—To Wiring Contractors. The Simplex Steel Conduit Company, Limited, beg to inform contractors and engineers that they have on their register the names of several wiremen experienced in the erection of the Simplex conduit system, who are now open for engagement. List of names and particulars sent on receipt of application, and employers are invited to make use of the facilities offered. 3619

TELEPHONE ELECTRICIAN requires engagement in or near Manchester; Private or exchange; estimating and control of men.—3447, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3447

(Continued on next page.)

(Continued on next page.)

SITUATIONS WANTED.—*Continued.*

TO Electrical Engineers.—Youth (18) desires situation as Assistant Electrician; lighting, telephones, bells, &c.—"X.," 212, Uxbridge Road, Shepherd's Bush. 3475

WANTED.—Situation as Improver, have had three years experience on private plant, wages not so much an object as chances of learning. Highest references.—"H. G.," Glen Chess, Loudwater, Rickmansworth. 3469

WIREMAN wants job, casing or simplex.—W. Charles, 57, Prebend Street, Islington, N. 3468

WIREMAN (Young), casing, Simplex, &c., good references.—"Electric," 44, Millbrook Road, Brixton. 3624

WIREMAN.—Casing, Simplex, situation.—"G.," 68, Vine Street Buildings, Tooley Street, S.E. 3621

WIREMAN wants job; casing, Simplex, &c.; full-rate.—G. Brown, 37, Radnor Street, Chelsea. 3615

WIREMAN, own casing and Simplex.—R. Steer, 3, Douglas Road, Maidstone. 3625

WIREMAN'S Assistant, lad (18), wants Job, 4½d.—"P.," 14, Hampton Street, Walworth. 3622

WORKS Foreman, practical, seeks engagement; 10 years' experience in accessories and switchboards, modern methods and shop management.—3628, Electrical Review, 4, Ludgate Hill, London. 3628

PARTNERSHIPS

PARTNERSHIP.—Capitalists desiring Partnerships or owners of well established businesses seeking Partners with capital are invited to apply for circular, published monthly.—Arnold and Co., 15, Pall Mall East, S.W., and 60, Queen Victoria Street, E.C. 3580

PARTNERSHIP.—Electrical Engineer desires active Partnership in established business. Capital about £5000.—3442, Electrical Review, 4, Ludgate Hill, London. 3442

PARTNERSHIP.—Electrical and Mechanical Engineer, 20 years' experience with leading firms, wants Partnership in sound business. Practical training, influential commercial connection at home and abroad, and some capital.—No. 3505, Electrical Review, 4, Ludgate Hill, London. 3505

WANTED as Partner, energetic young man, with capital, to assist in developing electrical engineering and contracting business.—No. 3443, Electrical Review, 4, Ludgate Hill, London. 3443

FOR SALE.

ARC Lamp Patents for Sale, or sole manufacture on royalty with good firm.—3603, Electrical Review, 4, Ludgate Hill, London. 3603

ELECTRIC Bells.—Shalm Gongs, 2¾ inch size, a few hundred to clear at 15s. dozen; samples, post free, 1s. 8d. A few dozen 2½ inch, with ordinary gongs, 13s. 6d. dozen; samples, free, 1s. 6d. A few Bell Boards, three bells on one base, 5s. set. 2½ inch wood pushes, a few hundred at 3s. dozen, 30s. gross. 2 inch ditto, 2s. dozen, 20s. gross. All new goods, cannot repeat when sold.—Wright, 318, Upper Street, London, N. 3543

ELECTRIC Lighting Plant for Sale; ¼-horse nominal Crossley Gas Engine, Dynamo, and 26 E.P.S. Cells for 26 lights; good working order.—Williams, 4, Brandcarn Road, Blackheath, London. 3465

ELECTRO-PLATING Dynamo by Canning, 4 volt, for sale.—Apply Kirkwood, 236, Leith Walk, Edinburgh. 3411

FOR Sale.—"Parker" dynamo, 75 amps., 220 volts, 650 revs. per min.; "Parker" motor, 17½ B.H.P., 200 volts, 500 revs. per min.; "Crompton" dynamo, 100 amps., 230 volts, 625 revs. per min.; "Crompton" motor, series wound, 20 B.H.P., 180 volts, 480 revs. per min.; slides and forcing screws, pulleys, &c., included.—Harry Roberts, electrical engineer, Blackheath, Staffs. 3455

FOR Sale as going concern, Small Mechanical Engineering Business with gas engine, tools, &c., well fitted, £350.—Full particulars on application to 3396, Electrical Review, 4, Ludgate Hill, London. 3396

FOR Sale or Hire, high class dynamos, motors, alternators, cable and arc lamps.—Percy Huddleston & Co., 72, Finsbury Pavement, E.C. 2902

FOR Sale.—Two Boosters for battery charging, Battery regulating switches, several 105 volt Crompton Motors, 6-in. Steam Piping, Cast Iron Exhaust Pipes and Bends, 50 Arc Lamps by leading makers, 105-volt Incandescent Lamps, Cut-out Boxes. Sundry other second-hand material, all in good condition.—3530, Electrical Review, 4, Ludgate Hill, London. 3530

FOR Sale.—In excellent running order, one ¾ H.P. Oerlikon system Motor, self starting, 110 volts, 40 to 100 cycles frequency, complete with starting box, loose pulley, and striking gear. Price £20, or may be exchanged for a similar "continuous" current motor. Can be seen at No. 76, Ludgate Hill, E.C., between the hours of 10 and 6 p.m. 3474

FOR Sale.—Arc Lamp Carbons, all sizes, suitable for any current.—A. G. Stockwell & Co., 69, Fenchurch Street, E.C. 3602

FOR SALE.—*Continued.*

FOR Sale.—Eight full-sized arc lamps, perfect working order.—Apply, "Z. 9," Morison's Advertising Agency, Hull. 3371

FOR Sale.—Searchlight, diameter 20 in., fitted with Diverging Lens and Chance Mirror, vertical and horizontal movements, worked by hand (wheels), complete with stand and sling for hanging over bows of steamship; make J. H. Holmes & Co.; Admiralty pattern; to be sold cheap.—H. T. Boothroyd, Hyslop and Co., Electrical Engineers, Bootle, Lancs. 3617

FOR Sale.—6 N.H.P. Grossley, 2 men-power Grossley, with pipes, accessories, &c. Shafting, pulley, and other mechanic tools. 110 volt 30 amperes Shunt Dynamo (almost new), Paterson & Cooper's make, complete; also Switchboard.—Apply by letter for appointment at Fabbro, 79, High Street, Battersea. 3619

FOR Sale.—75 K.W. Parsons Turbo-Alternator, 2000 volts, speed 3000 revs. per minute, periodicity 100, complete with exciter and new spare exciter armature, in first-class condition, being displaced to make room for larger plant. Can be seen running under load; offers invited.—Apply The Woking Electric Supply Co., Ltd., Board School Road, Woking, Surrey. 3629

FOR Sale.—One continuous current shunt wound Dynamo, 250 amps. 150 volts (Electrical Construction Company), coupled direct with a vertical compound engine, 50 H.P., 14½-in. L.P. cylinder, 9-in. H.P. cylinder, 10-in stroke, 200 revs. min.; 90 to 120 lbs. steam pressure (Davey-Paxman); engine and dynamo are self contained on one c.i. base. Only been running one year of 12 hours per day in all. As good as new. Reason for selling, putting down larger plant. Photograph if desired. Price £550 on truck Burton Station.—Apply, H. A. Couchman, Bass & Co., Burton-on-Trent. 3639

PAIR of horizontal steam engines made by Clayton & Shuttleworth, 75 lbs. W.P., 14¾ cylinders, 24 inches stroke.—Apply Bevingtons & Sons, Neckinger Mills, Bermondsey. 3564

PARKER Dynamo.—25 a., 220 v., 1000 r., self oiling bearings, slide rails, £30. General Electric Co. Dynamo, 40 a., 100 v., 850 r., self-oiling bearings, £28. Photo.—Martin, Electrician, Kidderminster. 3546

PLANING Machine to plane 8 ft. × 2 ft. 6 in. × 2 ft. 6 in., nearly new.—Martin, Electrician, Kidderminster. 3547

Q-TYPE, several second-hand cheap batteries for motor ignition, all other purposes, accumulator plates, best made.—Write for catalogue, Vandervell, North Kensington, London, W. 2991

SECOND-HAND Lighting and Plating Dynamos, Motors, Shaking Barrels, Lapping Lathes, Emery Wheel Machines, Vats, Fly Wheels, Dry Meter, Banding, &c., for sale cheap.—Canning & Co., Snow Hill, Birmingham. 3632

TESTING Set by Elliots:—Thompson Mirror Galvanometer, 10,000 ohms, with shunts and Post Office patttern Wheatstone bridge, cost £60; offers wanted. Photograph on application.—Martin, Electrician, Kidderminster. 3545

TWO series and one parallel Arc Lamps, 230 volts, Thomson-Houston make. Low price for quick sale, good as new.—3596, Electrical Review, 4, Ludgate Hill, London. 3596

110-VOLT Motors, first-class maker, about one dozen ¼-H.P. with starting and rheostats, new, perfect and complete. To be sold very cheap.—Apply, 3565, Electrical Review, 4, Ludgate Hill, London. 3565

ARTICLES WANTED.

ACCUMULATORS, Second-hand, any type, wanted; also lead peroxide, old copper cable, lamp tops, scrap metals, and every description of metallic dross purchased for cash, town or country.—Write, A. Brown, 77, Lansdowne Road, Dalston, N.E. Telephone: 326, Dalston. 3340

PLATINUM, in any form and quantity, purchased at highest prices by Derby & Co., 44, Clerkenwell Road, London. 3622

WANTED.—Electric Lamp Tops and Scrap Platinum.—Edey and Co., 29, Ludgate Hill, London. 2789

WANTED at once.—Shunt wound dynamo, 135 volts, 95 amps. Must be in perfect condition and cheap for cash.—Allam and Co., 11, Hatton Garden, E.C. 3389

WANTED.—Generator and Ohmmeter.—Joseph, 49, Queen Victoria Street, E.C. 3390

WANTED.—A Booster. Motor to run with 220 volts generator (preferably compound wound), to carry 100 amperes and give 50 volts. Offers of suitable motor or generator separately would be considered.—Address "Z. H., 887," Deacon's, Leadenhall Street, E.C. 3479

WANTED.—Shunt wound Dynamo, about 140 volts, 120—130 amperes; must be in first-class condition.—Particulars to W. O. Rooper & Co, Stafford. 3601

WANTED.—Electric Lamp Tops and Platinum Scrap.—H. Cross, 20, Citadel Street, Nottingham. 3633

MISCELLANEOUS.

ACCUMULATOR CHARGING.—C. H. Cathcart & Co., having plant specially adapted for this purpose, charge cells of all sizes promptly, thoroughly and cheaply. Terms on application. Accumulators on hire for temporary lighting, experimental uses, &c.—3, Dorset Buildings, Salisbury Square, Fleet Street, E.C. (Telephone No. 266, Holborn). 1865

(Continued on next page.)

MISCELLANEOUS.—*Continued.*

EPSTEIN Accumulator Plates for Storage Batteries are now supplied by the sole licensees and makers, W. O. ROOPER AND Co., Electrical Engineers, Stafford. 80

EXPERT Designer of modern continuous current machinery, wide experience, thoroughly practical, can guarantee economy of production and reliability in operation; will devote portion of his time; terms exceedingly moderate.—3461, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3461

TO Electric Fittings Manufacturers.—A firm of electrical engineers having taken extensive showrooms in the best West End thoroughfare, are prepared to receive offers from manufacturers who are willing to supply electric light fittings for show purposes either "on sale or return," or other suitable terms.—Apply in first instance, Box 3581, ELECTRICAL REVIEW, 4, Ludgate Hill, London. 3581

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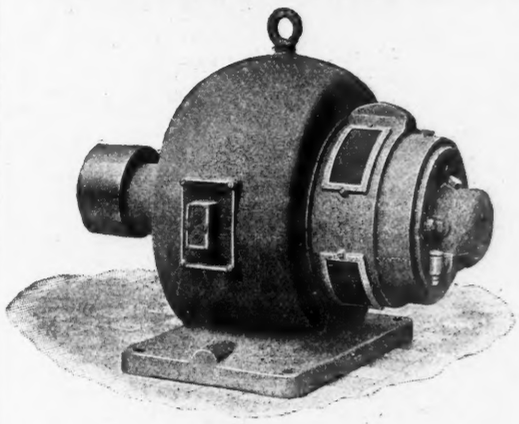

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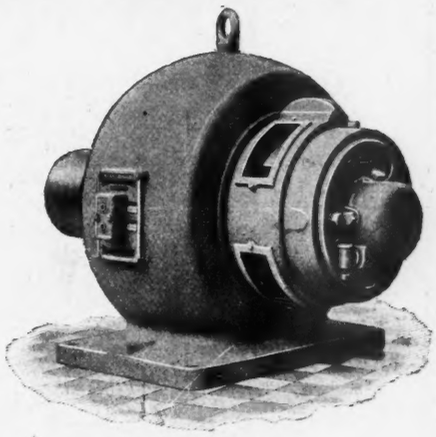

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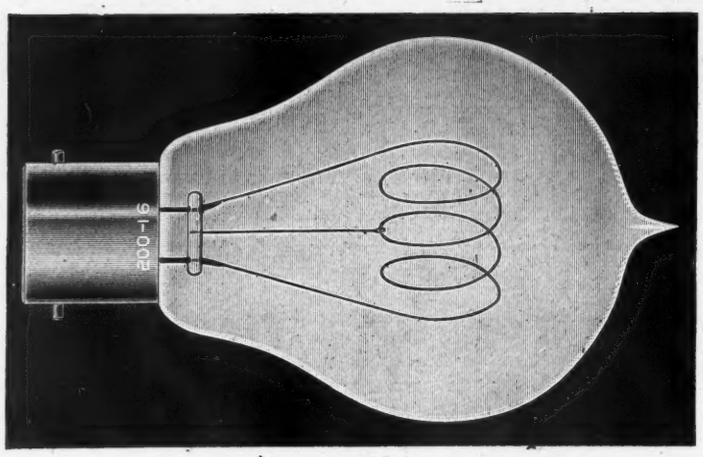

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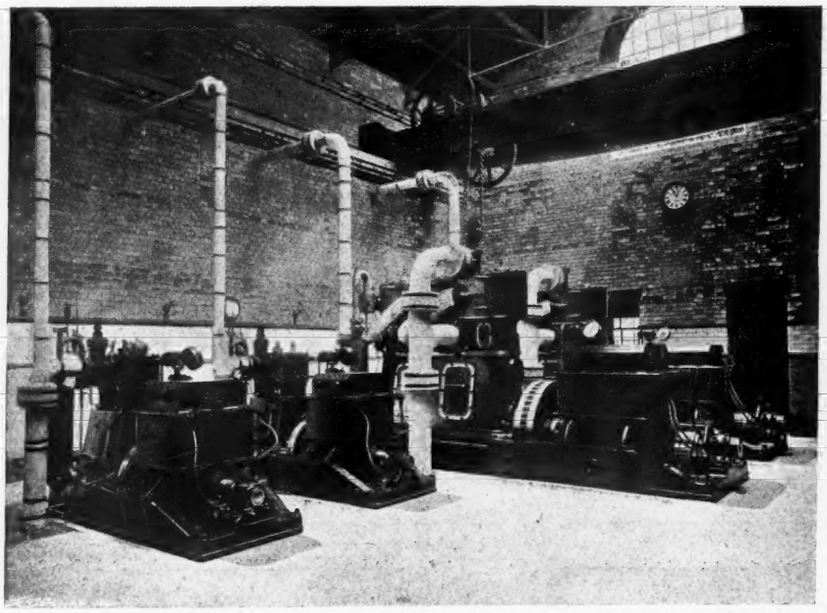

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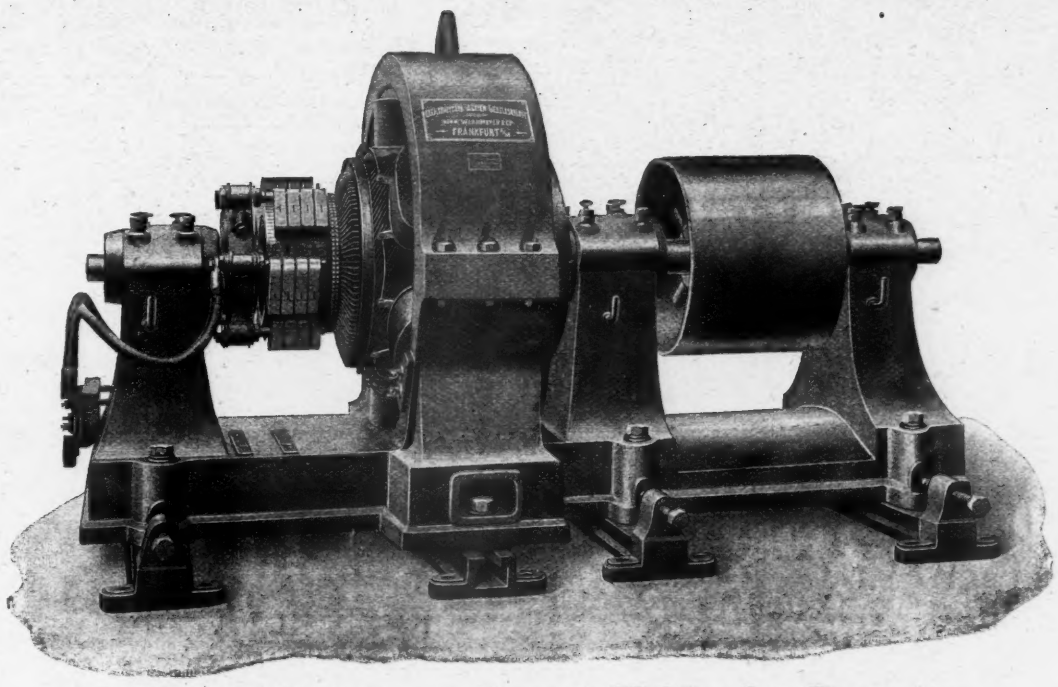

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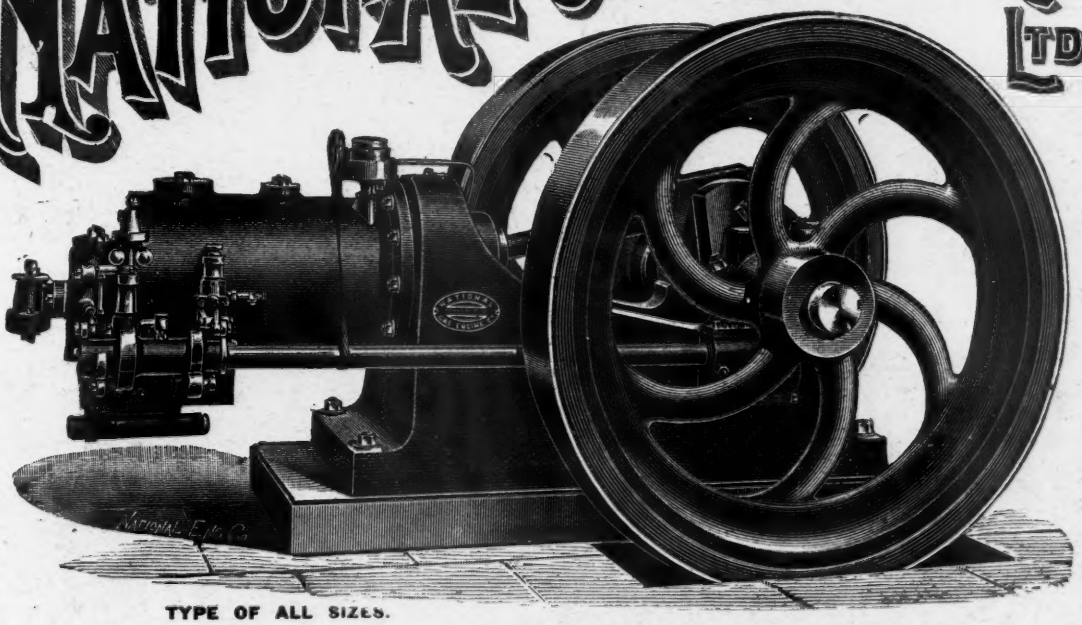

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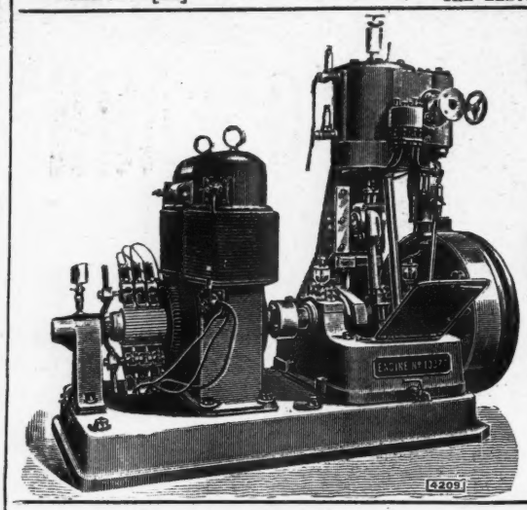

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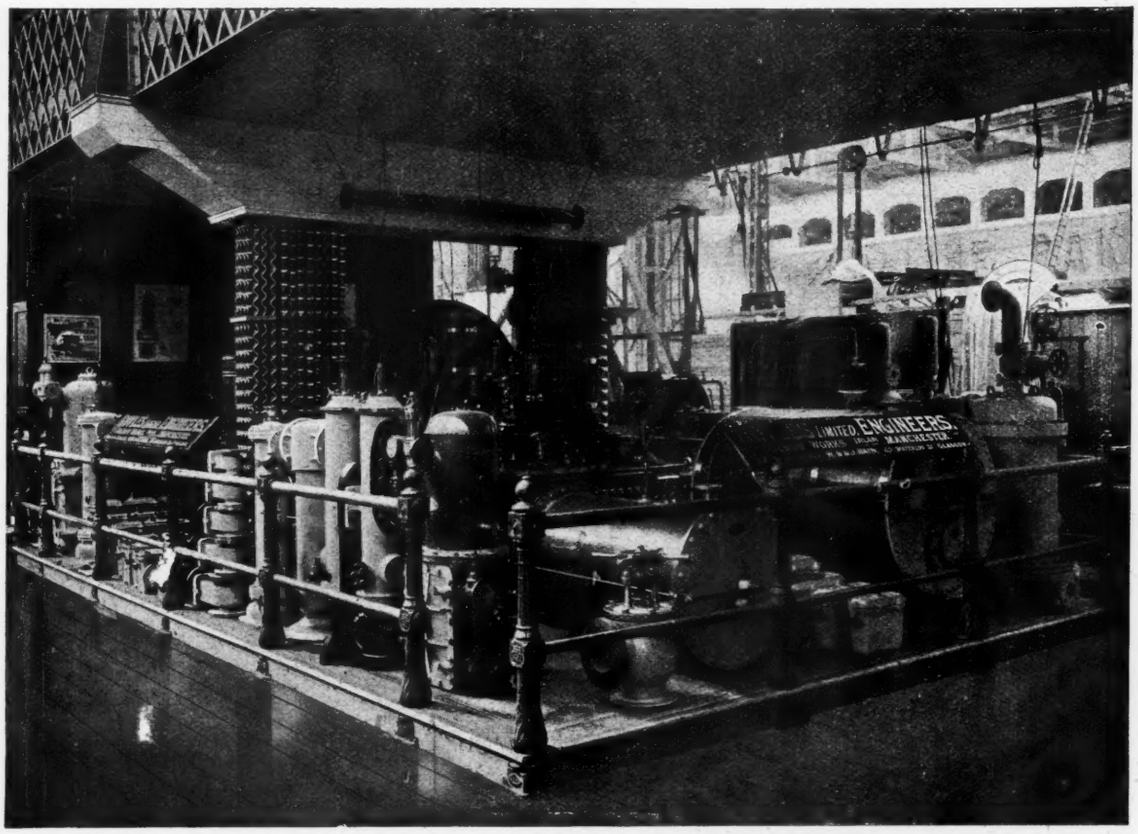

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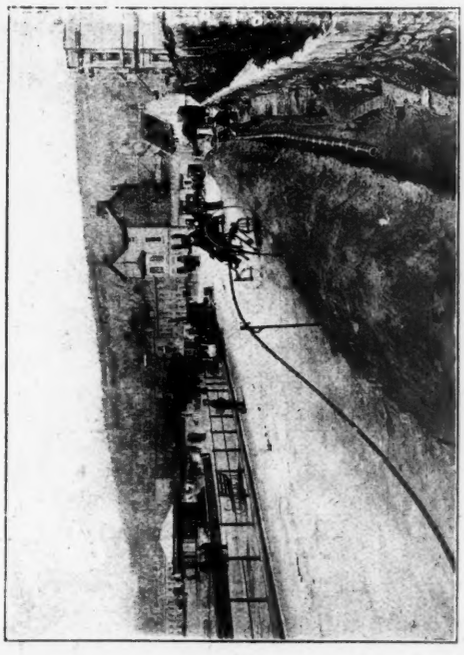

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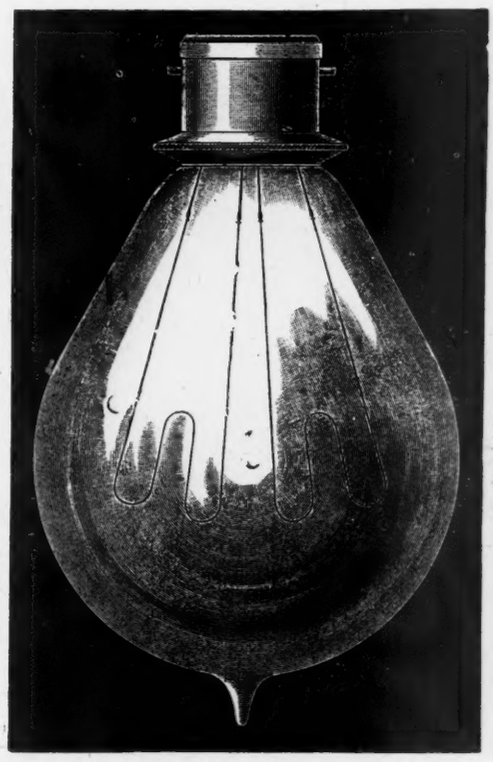

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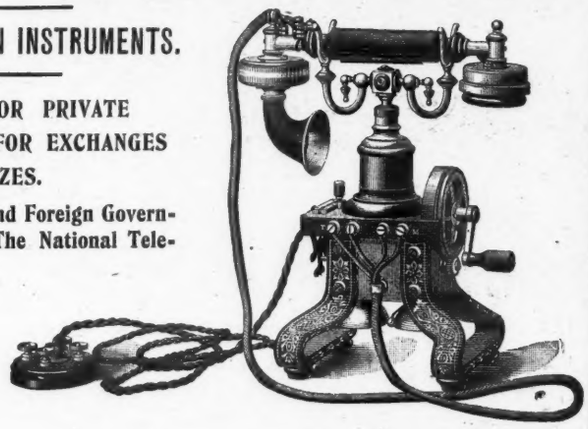

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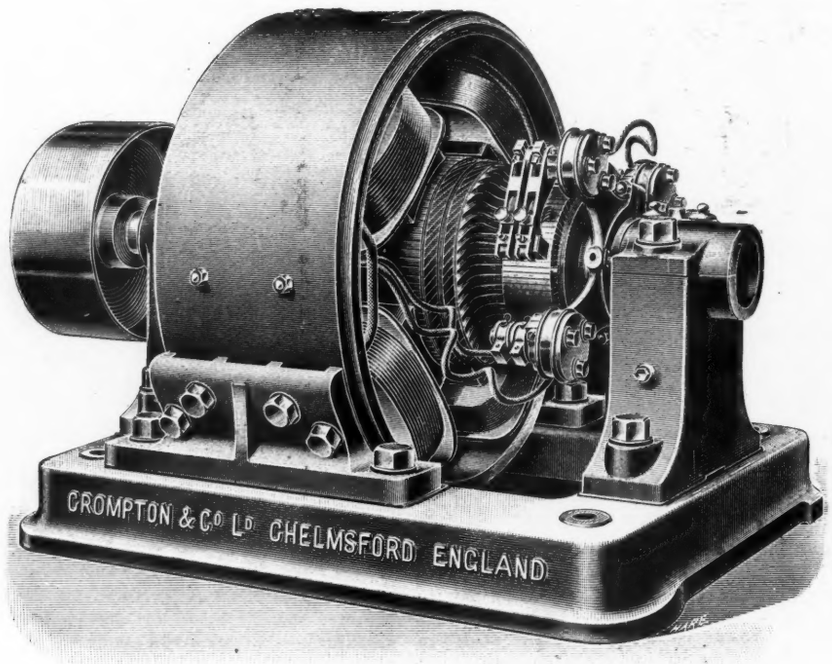

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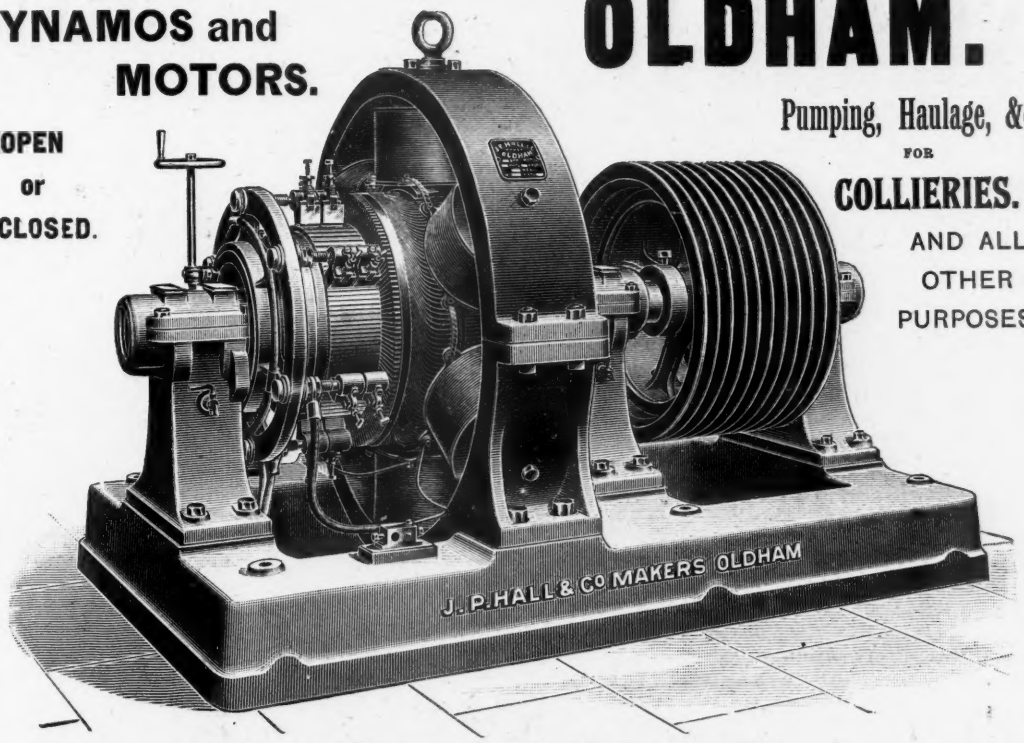

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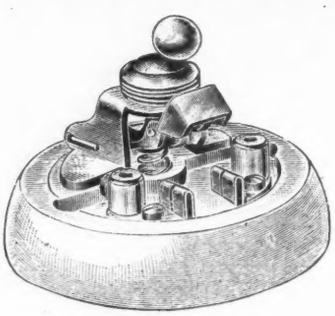

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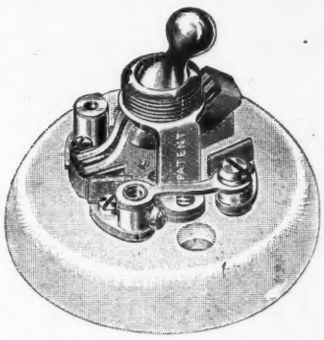

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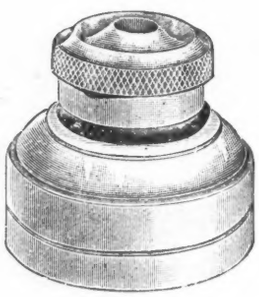

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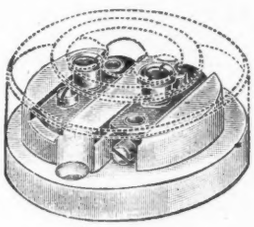
Nos. 91 96.



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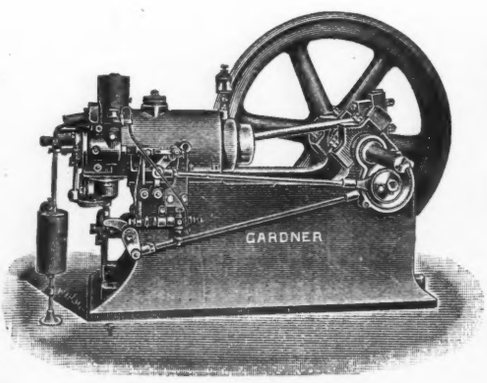

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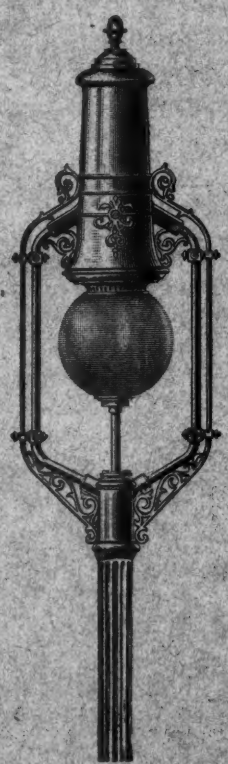

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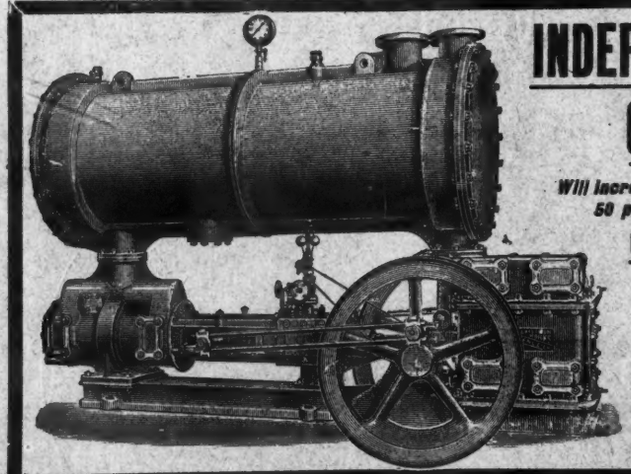

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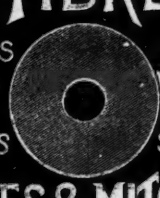

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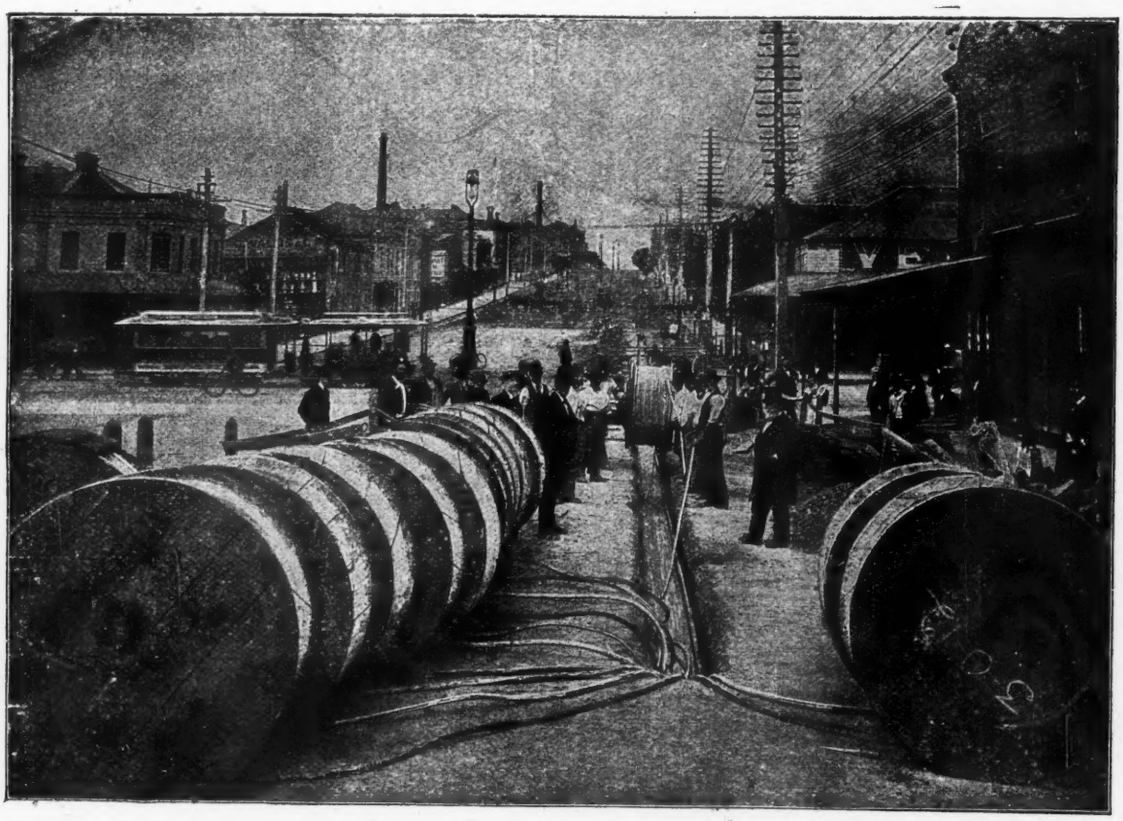

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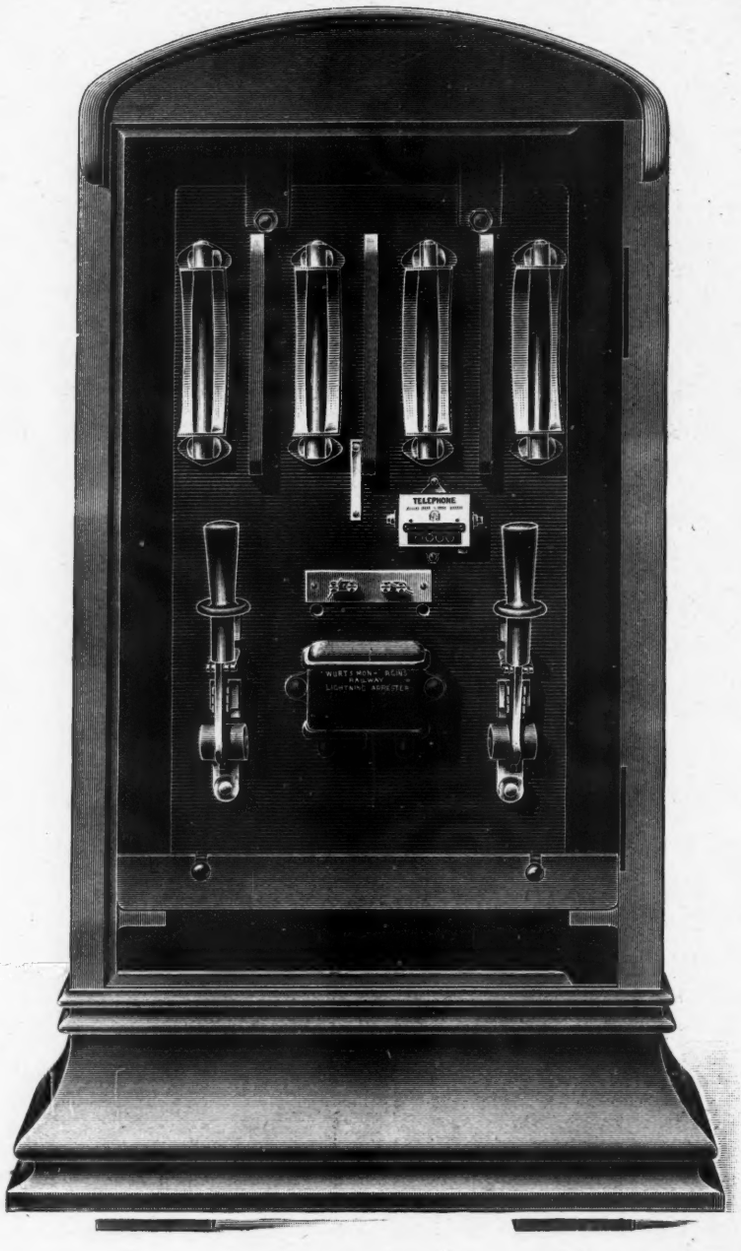

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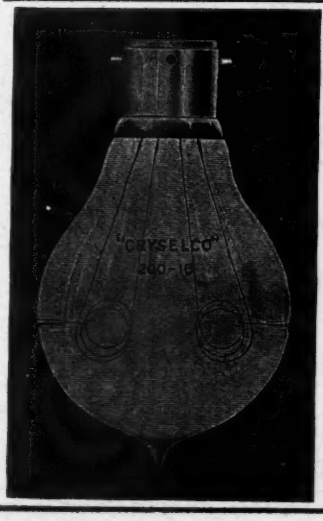

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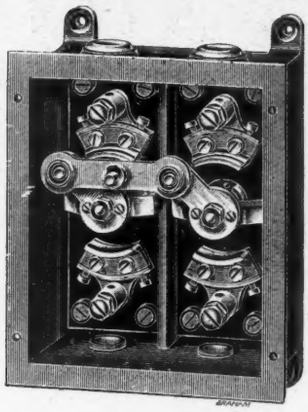

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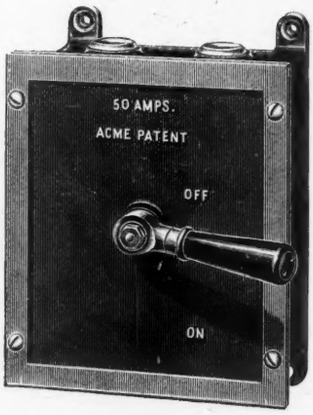

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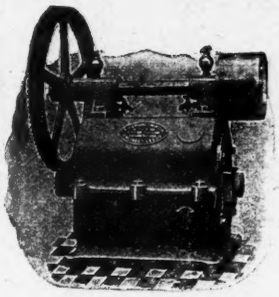

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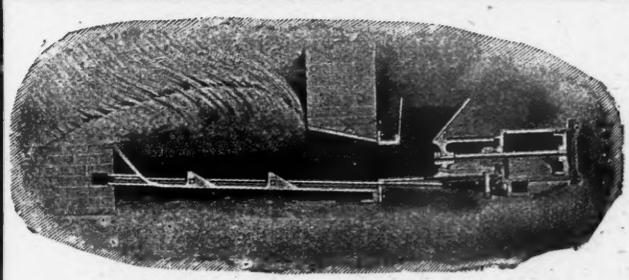

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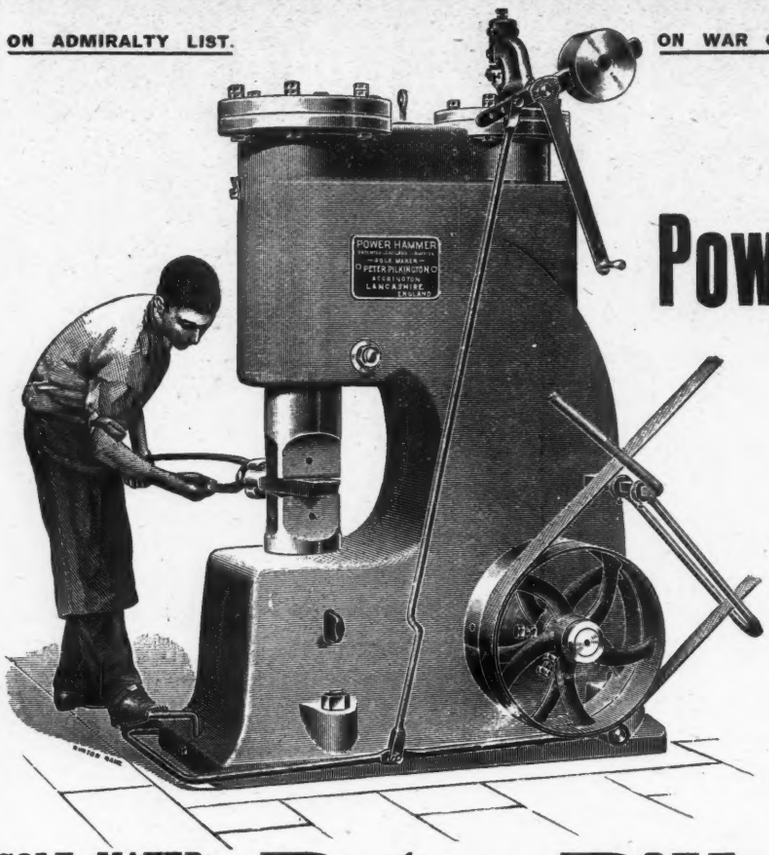

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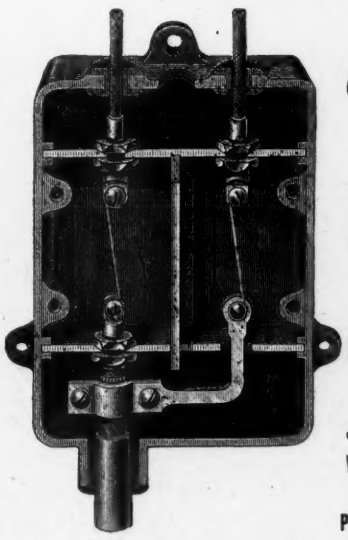

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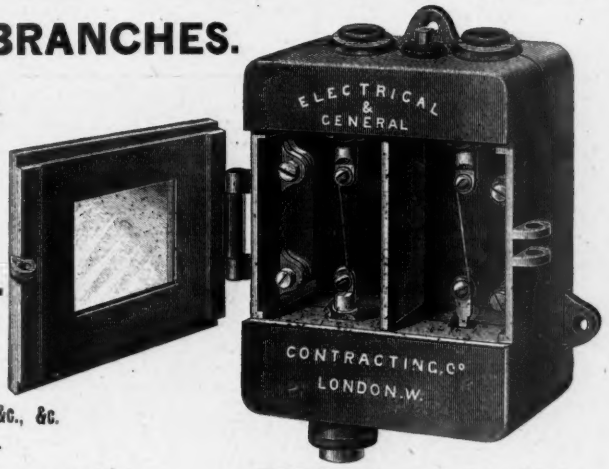

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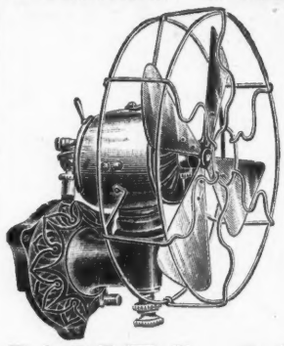

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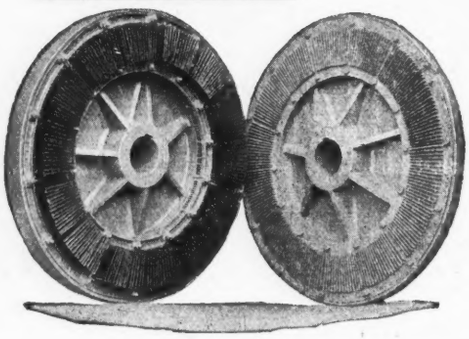

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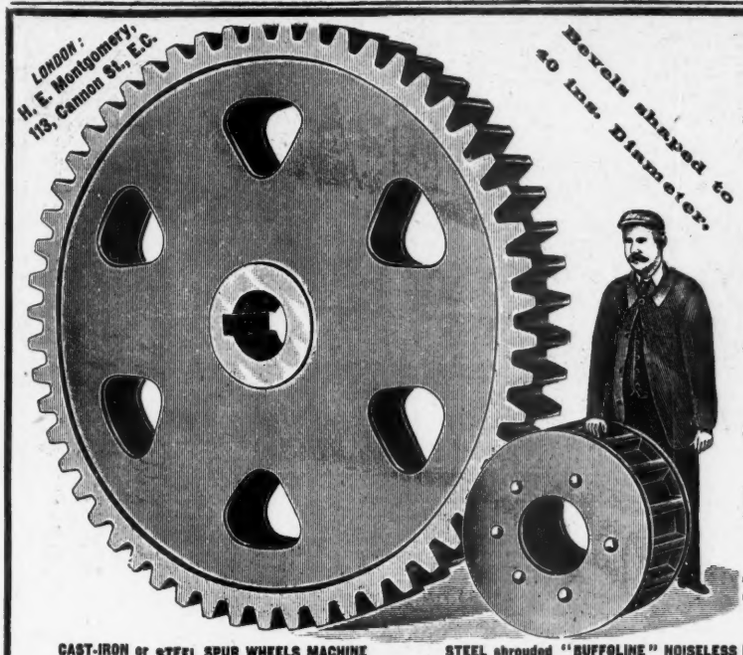

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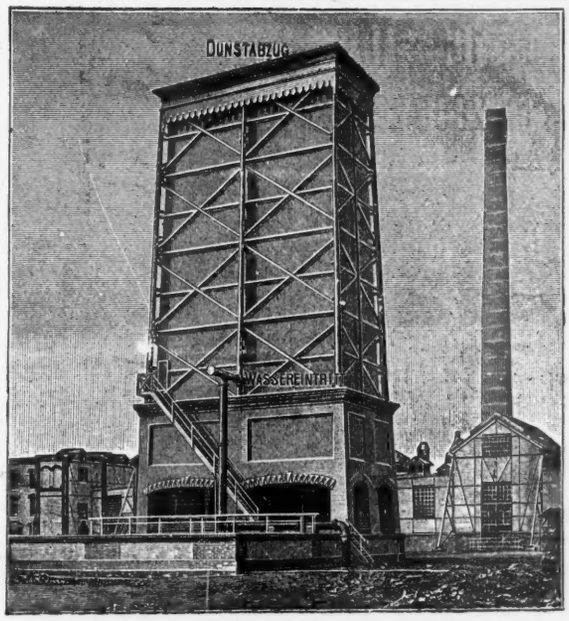

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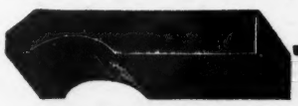

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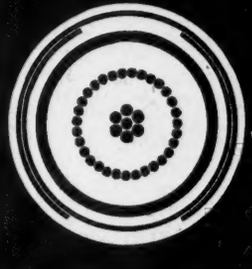

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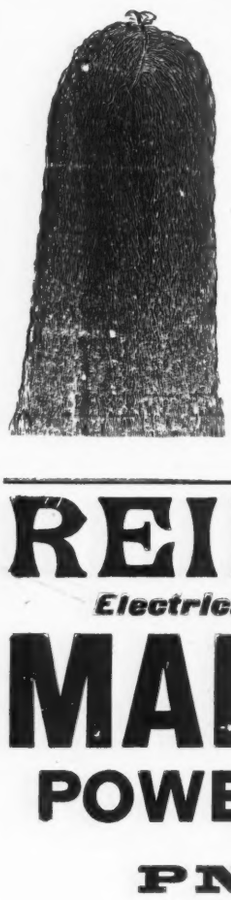

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MAKERS OF EVERY DESCRIPTION OF

ELECTRIC LIGHTING MATERIALS.

Thoroughly High Class and Reliable, at Lowest Prices. *The Most approved* **HIGH VOLTAGE** *Designs.*

A GOOD ASSORTMENT AND LARGE STOCK TO SELECT FROM.

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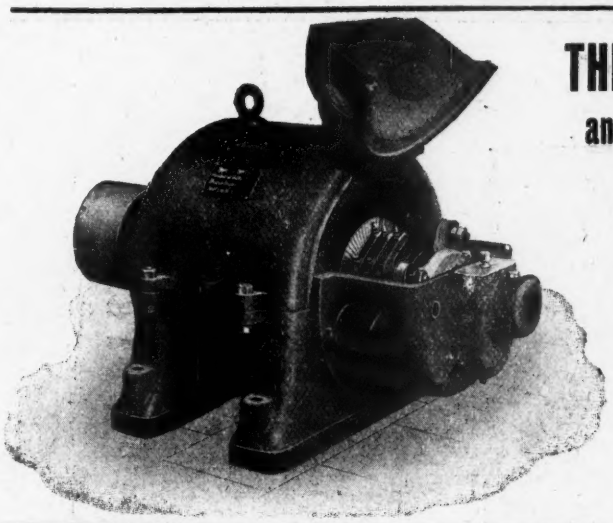
And at LIVERPOOL and GLASGOW.



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SUITABLE FOR

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ANY TEMPERATURE, PRESSURE and SPEED.

NO ALTERATION OF STUFFING BOX.

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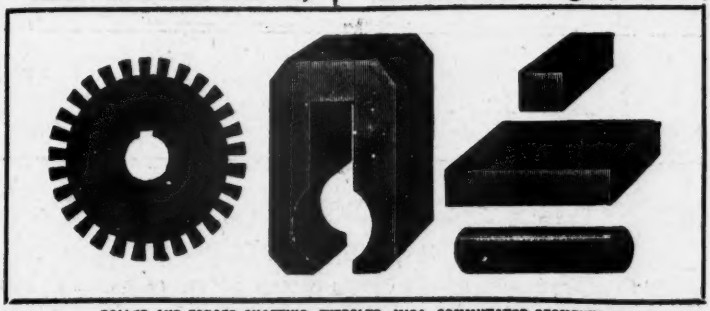

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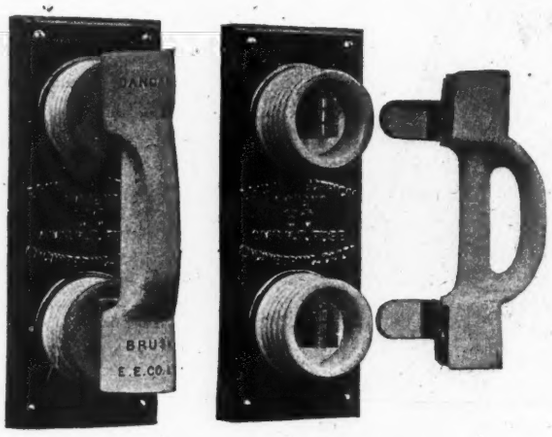

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STORAGE BATTERIES.

E.P.S.

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TOTAL CAPACITY

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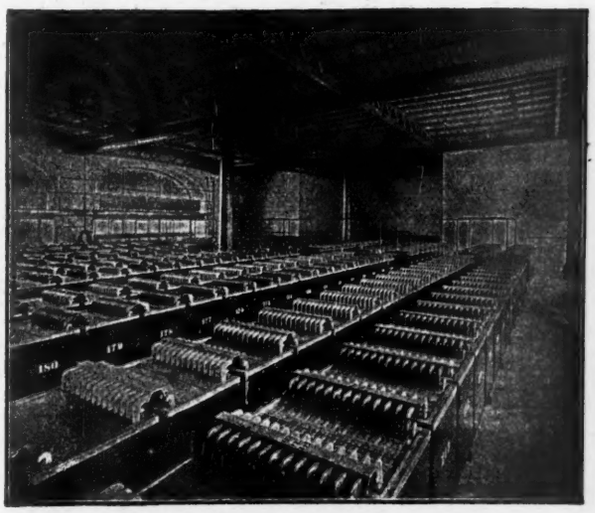
WATT HOURS.



Battery of $K^{LP.}$ Cells at Bramley Moore Station

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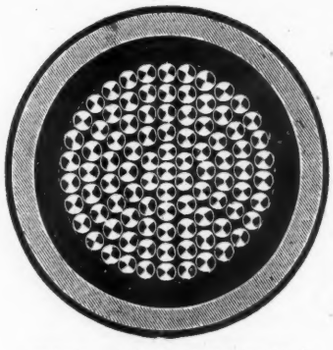

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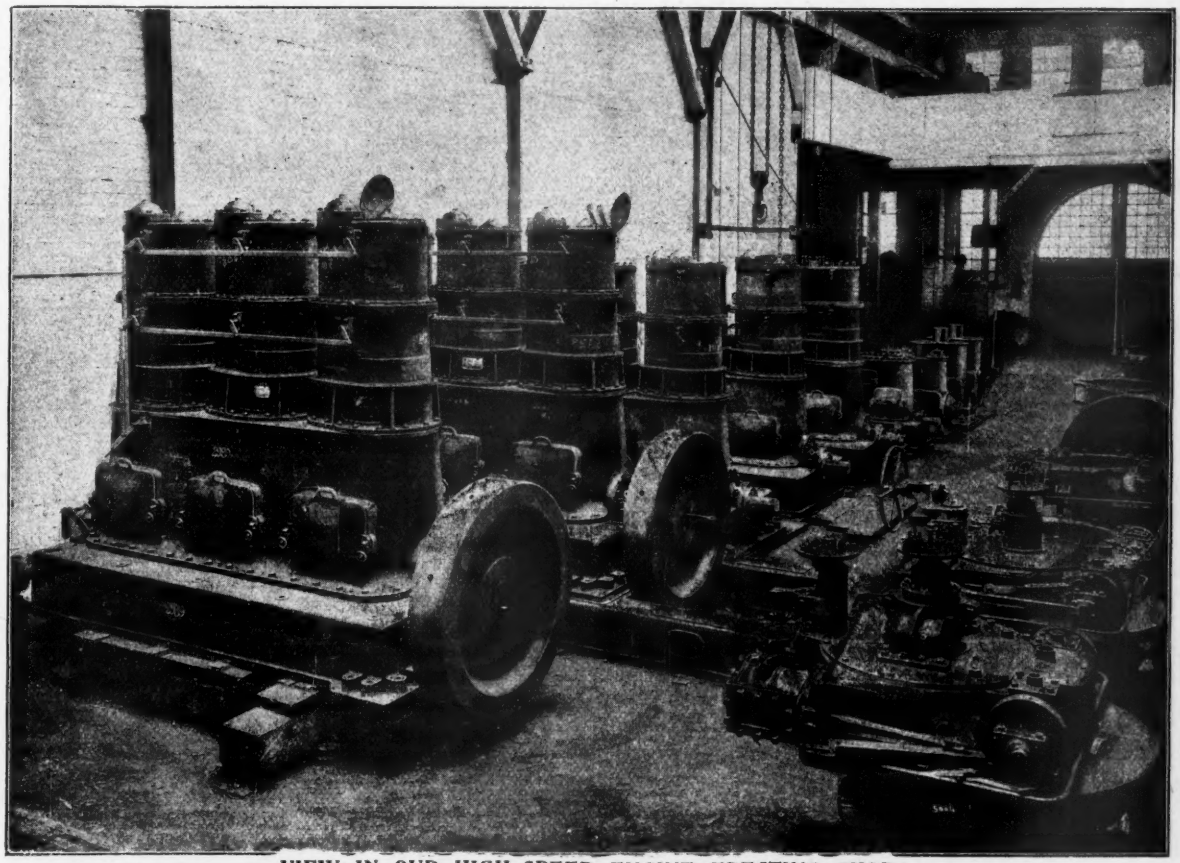
"SENTINEL"

High Speed Engine.



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SIMPLICITY, DURABILITY,

EXCELLENT GOVERNING,

SILENT RUNNING,

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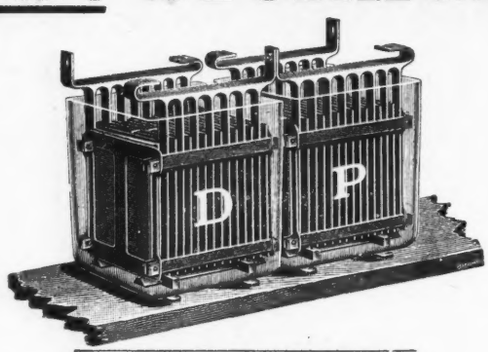
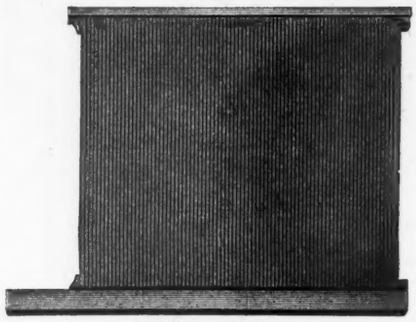
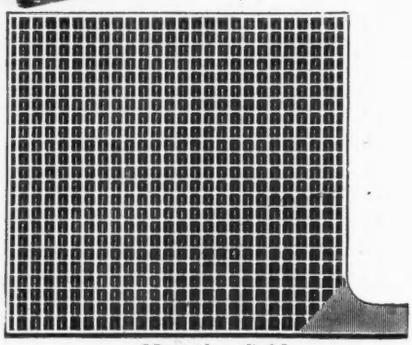
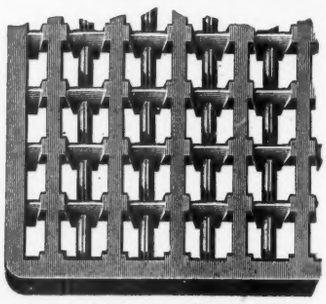




Positive Plate.



Negative Grid.



Enlarged Section of Negative Grid.

THE COUNTRY HOUSE ACCUMULATOR

NOTICE OF REMOVAL.

The D.P. BATTERY CO., Ltd.,

beg to give notice that on and after June 24th, 1901, the registered offices of the Company will be

11, Victoria Street, Westminster, London, S.W.

to which all orders and correspondence should be addressed. The Lumford Mills, Bakewell, Derbyshire, having been extended and nine acres of additional land purchased (making a total of 15 acres) the whole of the manufacturing will in future be concentrated at these works.

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The Directors have pleasure in announcing that, owing to the introduction of labour-saving machines in the various departments, with a corresponding increase of production and the use of water-power for formation, they are able to offer a substantial reduction in prices.

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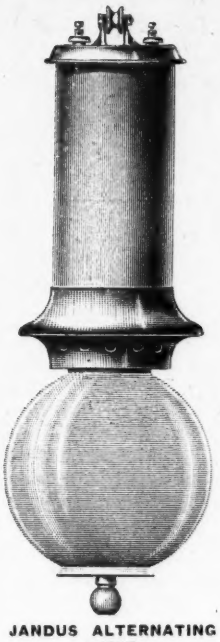
FOR

ALTERNATING CURRENT

ARE DESIGNED and CONSTRUCTED on SCIENTIFICALLY MECHANICAL LINES. THE DUST-PROOF MECHANISM IS AS SENSITIVE AS A WATCH, BUT CAN EXERT AMPLE POWER IF THE NECESSITY ARISE.



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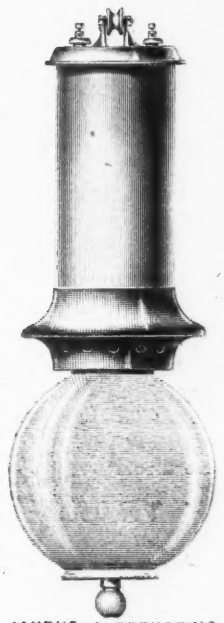
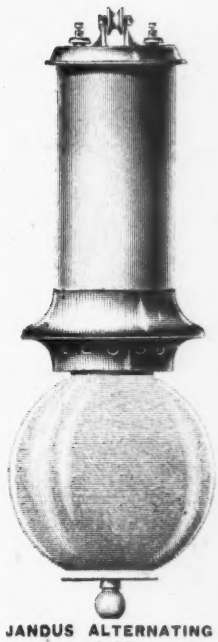
THEY EXCEL

IN LIFE, DURABILITY, SIMPLICITY, POWER-FACTOR, STEADINESS and QUALITY OF LIGHT, and INTRINSIC WORTH.



JANDUS ALTERNATING LAMP.



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Buyers and Users are warned that they will be held equally liable with Agents and Manufacturers for any Enclosed Arc Lamps they may purchase which are Infringements of the JANDUS PATENTS.

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Telegrams:—
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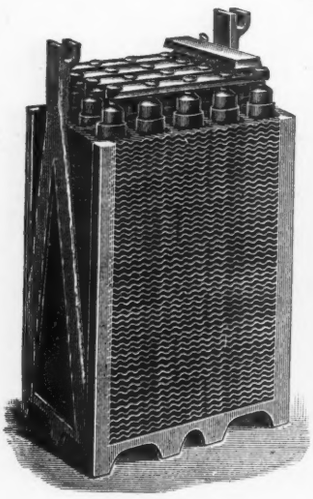
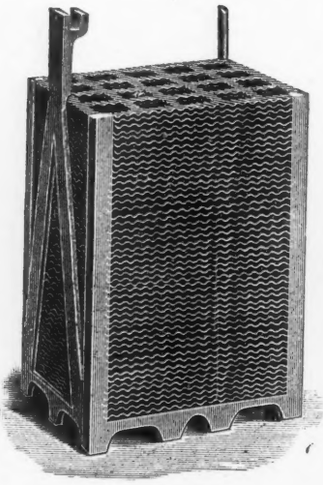
MONOBLOC

THE TRACTION ACCUMULATOR.

(FULLY COVERED BY PATENTS.)

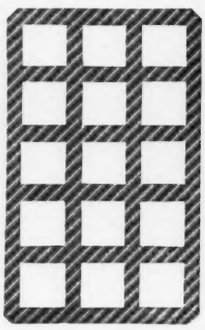


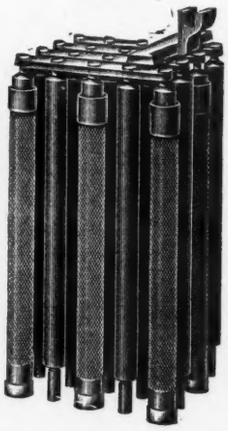
Complete Cell.



Positive Block.

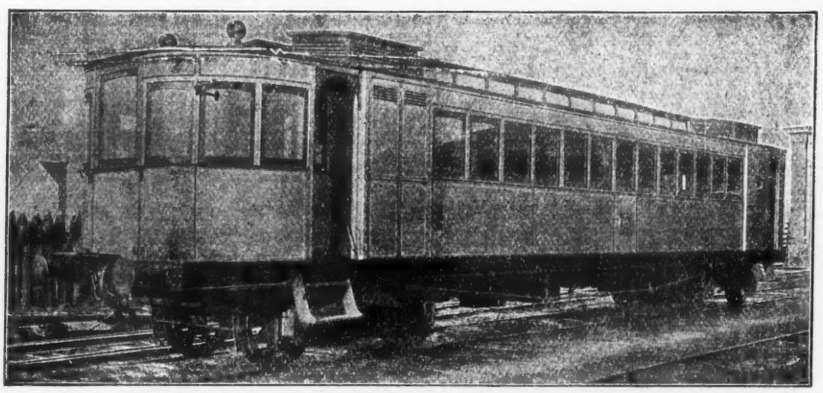
The Positive Block is built up with horizontal sheets, having holes punched for reception of the negative rods arranged vertically, thus:





Negative Rods.

THE RESULT OF YEARS OF EXPERIENCE.



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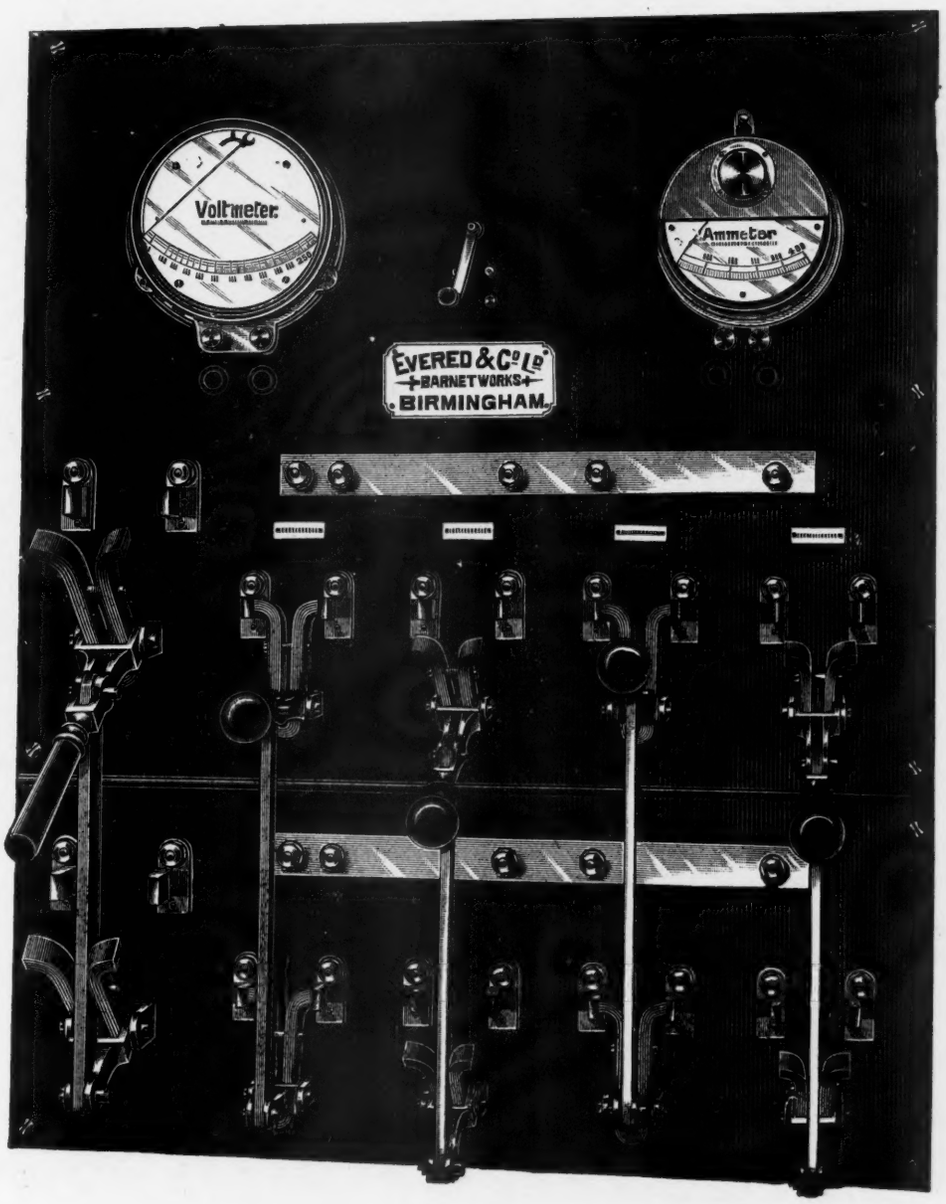
ALL SWITCHES AND FITTINGS OF THE VERY BEST FINISH.



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For Belt Driving or Direct Coupling.

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Single-Phase or Polyphase.

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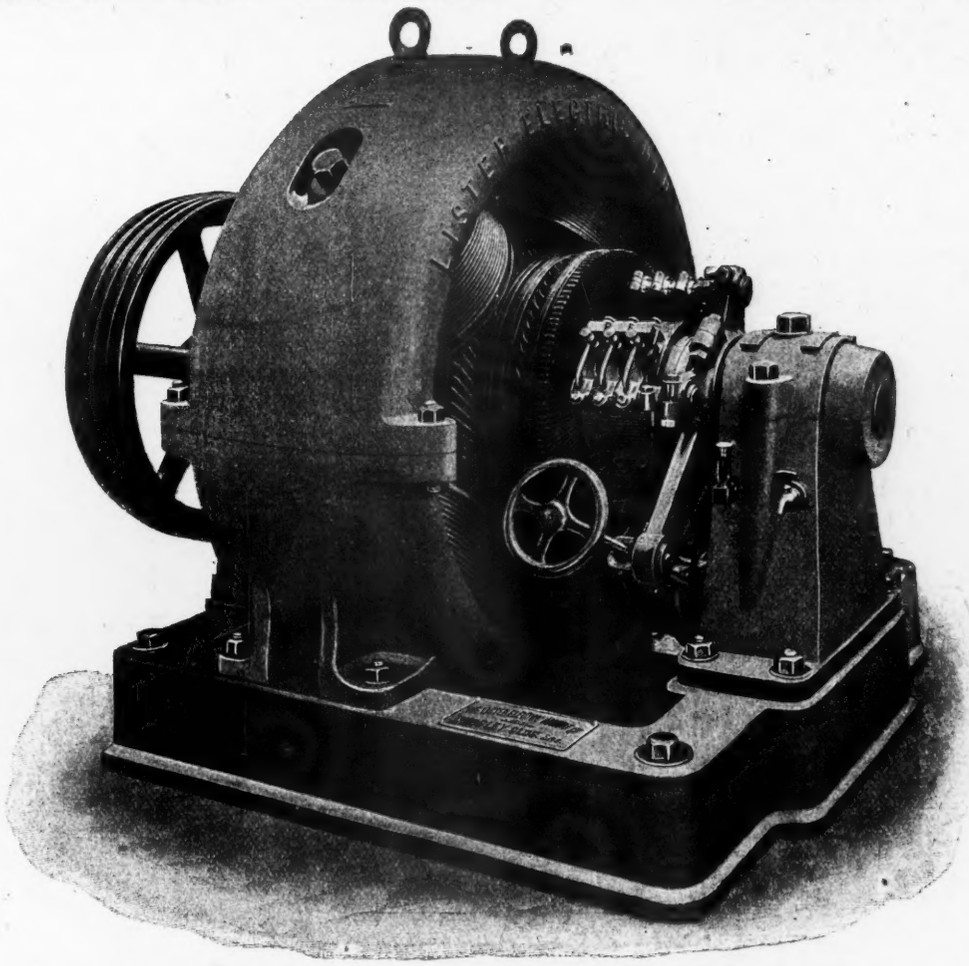
Telegraphic and Cable Address:—"ELECTRICITY, DURSLEY." *National Telephone:—No. 6 Dursley.*



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MULTIPOLAR DYNAMOS BELT OR ROPE DRIVEN.
DIRECT COUPLED SETS FOR LIGHTING OR POWER TRANSMISSION.
OPEN AND ENCLOSED TYPE MOTORS, BALANCING SETS, BOOSTERS, &c.

We are Makers of all kinds of Tramways Fittings, such as
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SPECIAL FITTINGS DESIGNED TO SUIT ANY REQUIREMENTS.

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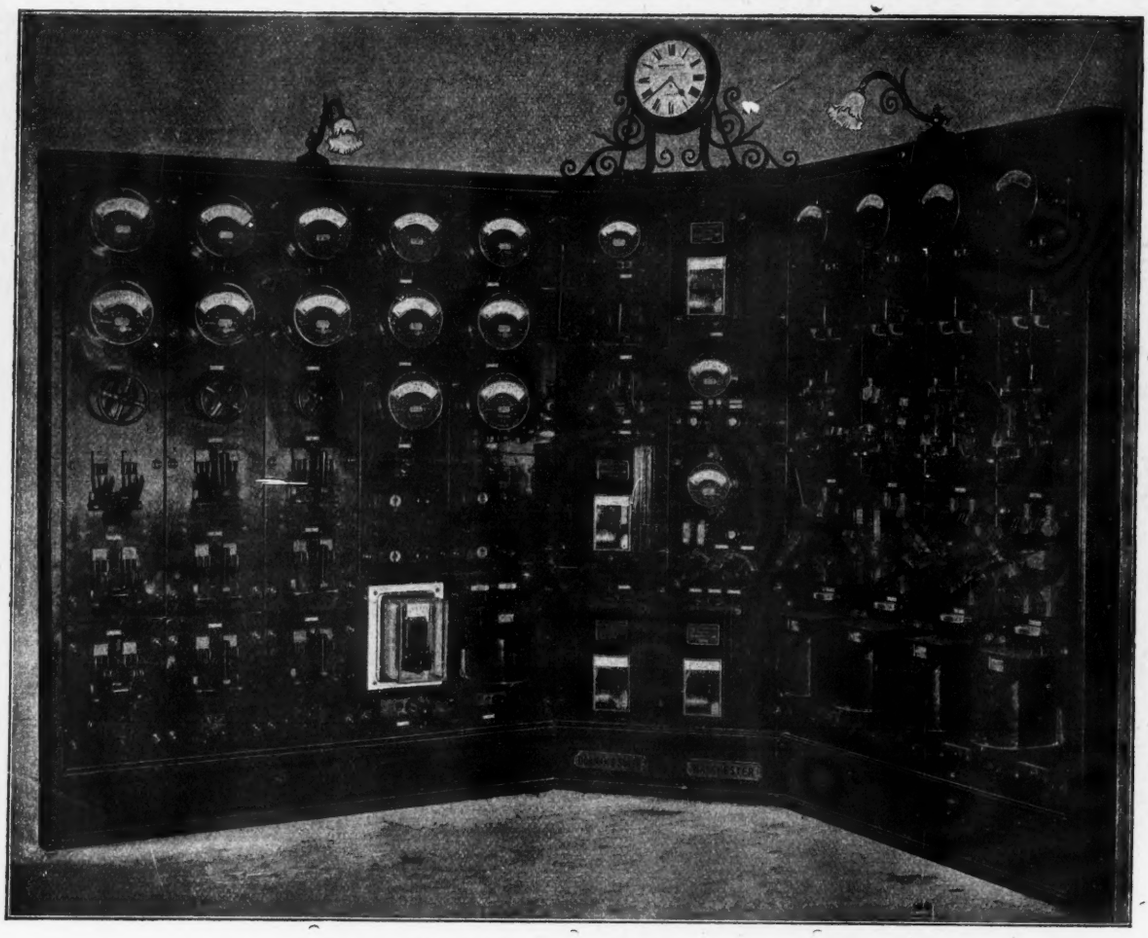
MAIN SWITCHBOARDS.



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FITTED WITH D. & S. PATENT CIRCUIT BREAKERS.

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ASHTON-UNDER LYNE. Traction and Lighting.
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Of Controlling Gear and Accessories for Electric Light and Power Installations as specified by many of the Leading Consulting Engineers and as used by the Principal Contractors at Home and Abroad.

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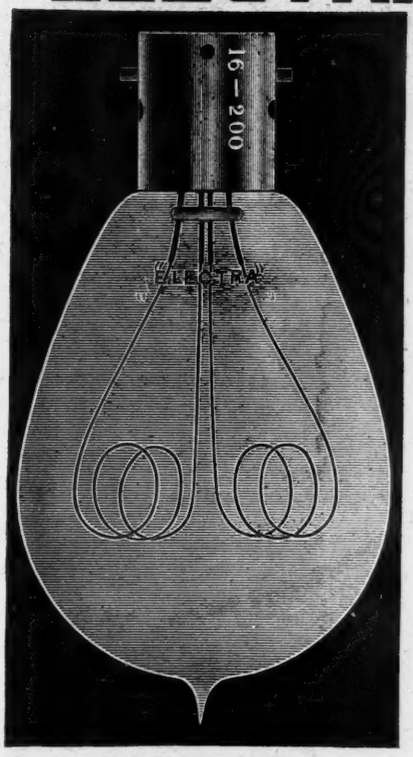

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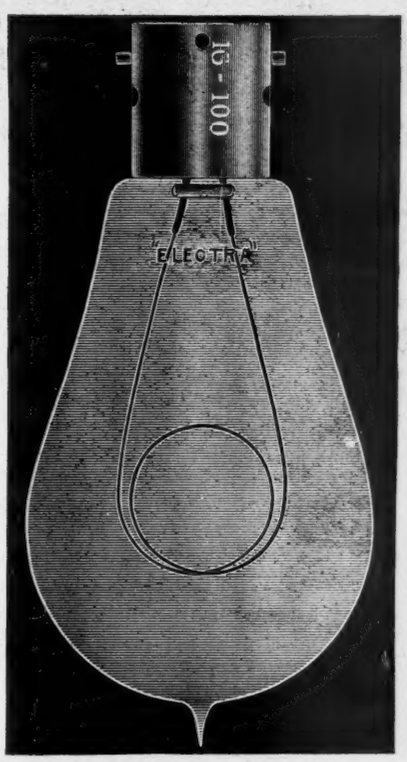

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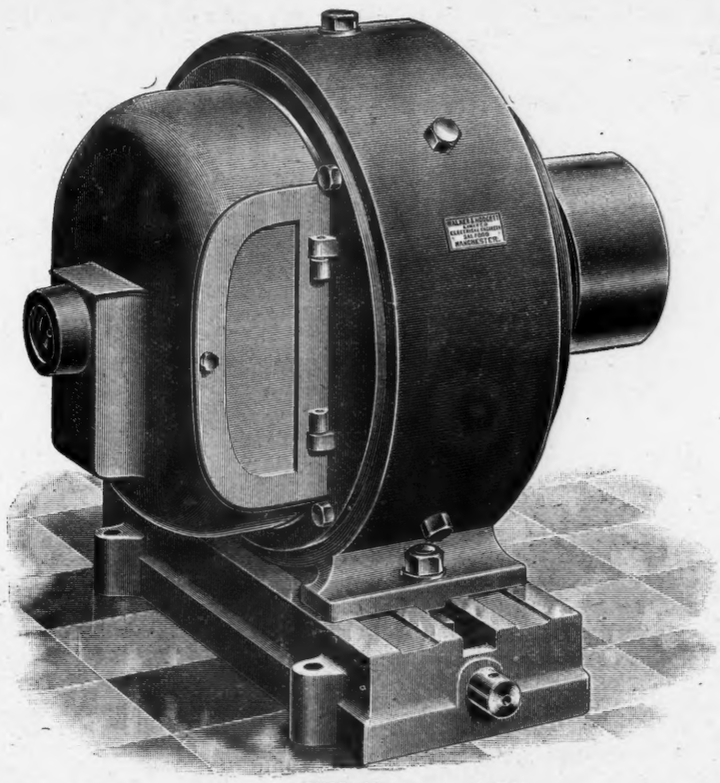

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WALKER & HODGETTS, Limited,

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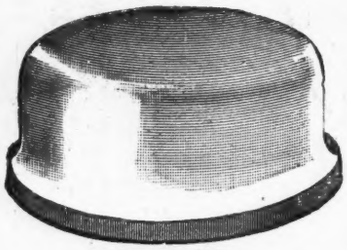

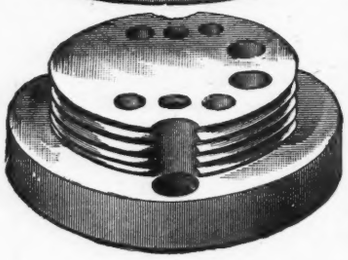

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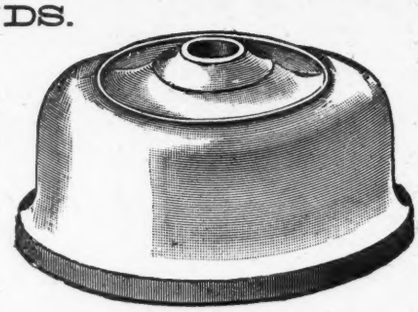

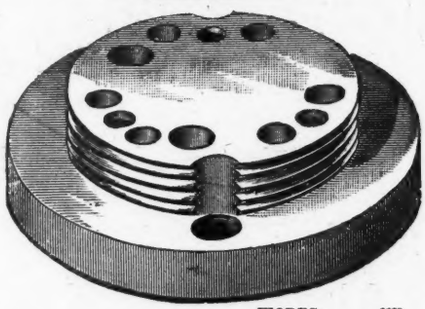

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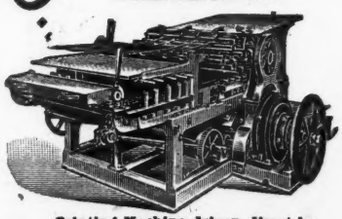

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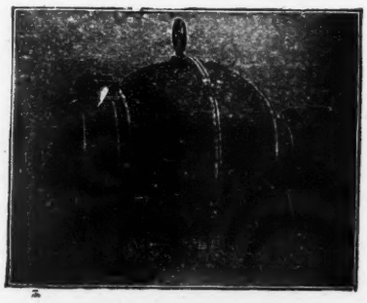

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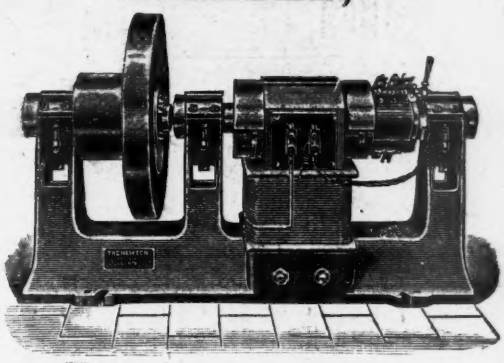

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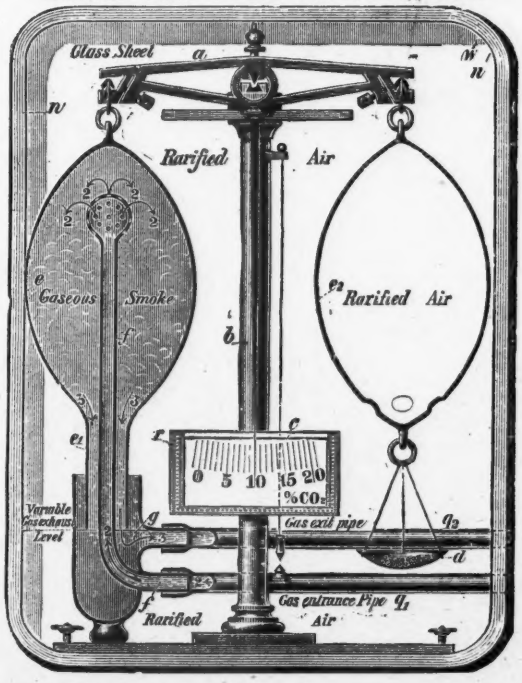

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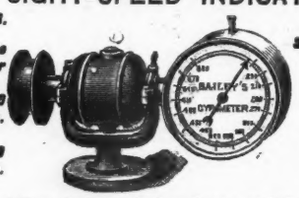

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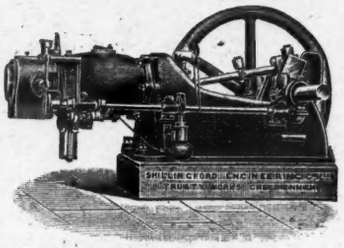

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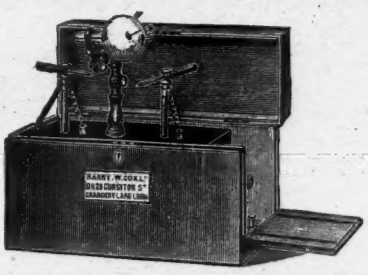

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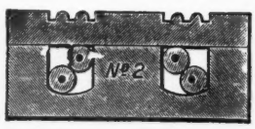

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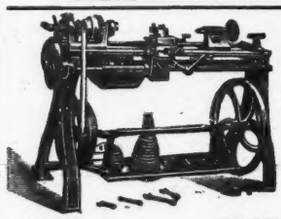

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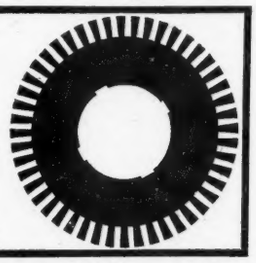

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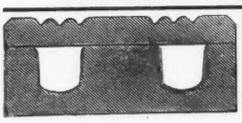

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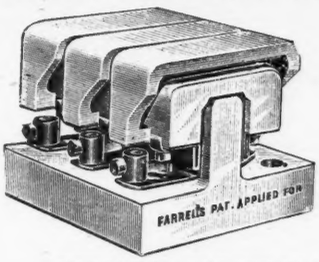

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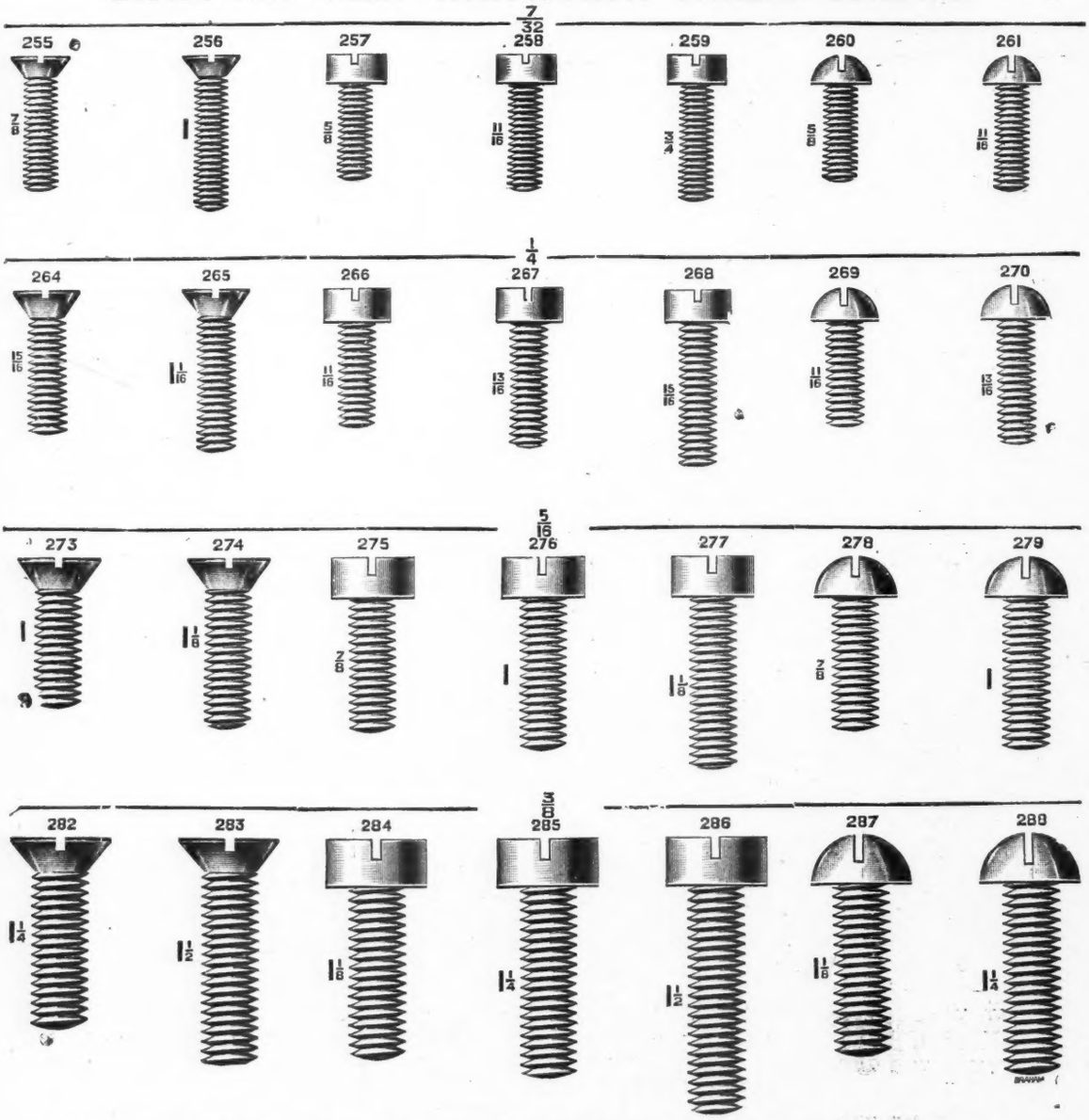

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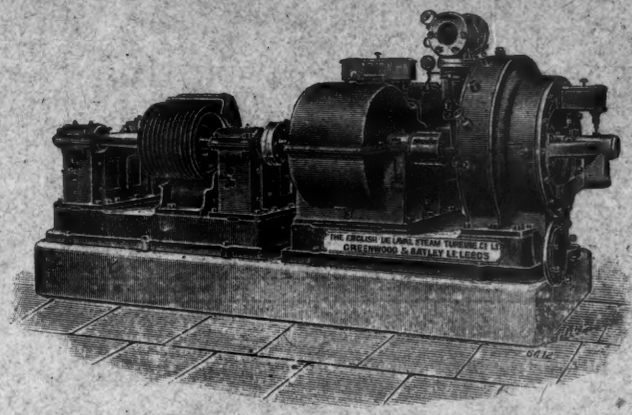

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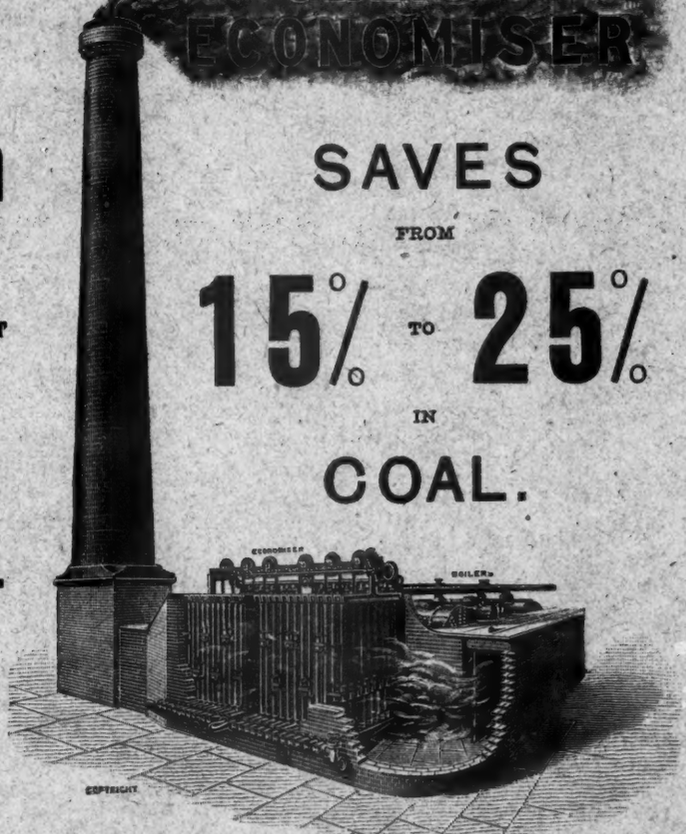

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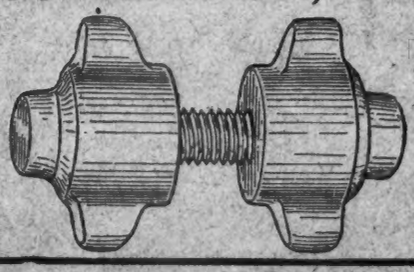

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